JOURNAL

OF THE

Department of Agriculture

OF

WESTERN AUSTRALIA.

Vol. 11. (Second Series) DECEMBER, 1934. No. 4.

THE LOCUST MENACE.

(*Chortoicetes terminifera.*)

By L. J. Newman, F.R.E.S., Government Entomologist.

The man on the land has, indeed, many and varied troubles to face.

Apart from the vicissitudes of markets, his life is a never ending fight against adverse forces of nature. He has to battle with the rabbits and other vermin, and weeds, and now he is faced with the problem of locust control. The order of insects to which the locust belongs is known as the Orthoptera. The word Orthoptera is derived from the Greek, Orthos straight and Pteron a wing, and refers to the fact that all the winged members of this order are provided with a pair of primary wings not used in flight, but which, when the insect is at rest, are folded back in a straight line with the body, covering the secondary or membraneous flight wings.

Locusts are all known as mandibulate insects, that is they are provided with mouth parts, which enable them to bite or chew their food. It is very important to know whether an insect chews or sucks, as this largely governs the method of control. The natural habitat of the locust is hot or temperate regions containing areas of dry or semi-arid lands and where the climate is subject to varying conditions of rainfall. Perhaps of all insect pests the locusts are most to be feared. They are general vegetable feeders and attack in gregarious or massed formation, and soon lay waste a crop of wheat, pasture, or fruit. Other insects may do an equal amount of damage during the year, but it is more gradual and is not done whilst we look on, so to speak. With the growth of agriculture, settlement has been pushed northwards and eastwards into districts which a few years ago were considered of little use from an agricultural point of view, and in so doing we have encroached upon the natural breeding grounds of the locust.

The clearing of the timber and scrub has brought about a considerable reduction of the insectivorous bird life, which is always a great factor in the control of insects. The ringbarking and destruction of the timber has materially altered the topography of the country and has removed the natural barriers which confined the pest to certain natural areas. It has also opened up the way for a westward spread of the locust. Lands so cleared do not naturally produce much growth unless broken up and cultivated. These conditions of open, bare areas have been readily taken advantage of by the invading locusts, and instead of returning to their natural breeding grounds, they have established themselves in the new artificially created breeding grounds. In recent years the position has been greatly aggravated by cleared lands throughout the locust areas which, for various reasons, have been put out of cultivation. Every such uncultivated area, for instance stubble paddocks not cropped or fallowed the following season, until they become grassed, is a

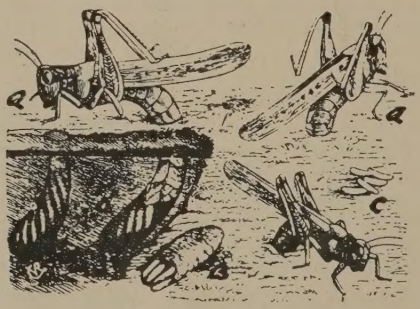
definite menace to the agricultural and pastoral industries, on account of army worms, other insects and pests, in addition to the locusts.

The addition of these artificial breeding grounds within the wheat areas to the natural breeding grounds has rendered the locust position more dangerous and difficult, and sooner or later, if action is not taken to prevent it, there will be a recurrence of the damaging swarms which so seriously attacked the crops and pasture in the new farming districts some years ago.

It is not only in the immediate areas where the locusts are bred that the danger exists, for, when a swarm becomes winged, crops or grass many miles away may suffer. Fortunately the locust with which we have to deal in the wheat areas does not usually migrate long distances as do some species in other parts of the world. A flight of 10 to 20 miles is, however, not uncommon, when the pest is pushed for food. It therefore behoves farmers in any portion of a road board area or district to be very interested in any outbreak that may occur in such area.

The initial swarms of hoppers may only affect those crops in the immediate vicinity, but it must be remembered that these same hoppers, if not destroyed, eventually become winged, and crops many miles away from the hatching grounds may be attacked and destroyed. It is therefore obvious that an outbreak in any district is of common interest to all and should be attacked co-operatively.

It is recommended that each infested district combine through its road board or other constituted medium, to make a co-operative effort for the destruction of the pest. This is essential not only to protect the other fellow, but from the more selfish motive of self-preservation. The great difficulty during previous outbreaks has always been the man with the crop not immediately endangered, who refuses to co-operate in efforts made to suppress the plague whilst in the hopper stage. This same farmer later on finds his area suddenly invaded by winged swarms of hungry locusts, which rapidly make short work of the ripening crops. Once on the wing, the control of this pest is rendered almost impossible and very costly. If attacked in the young hopper stage they can be successfully and economically poisoned.

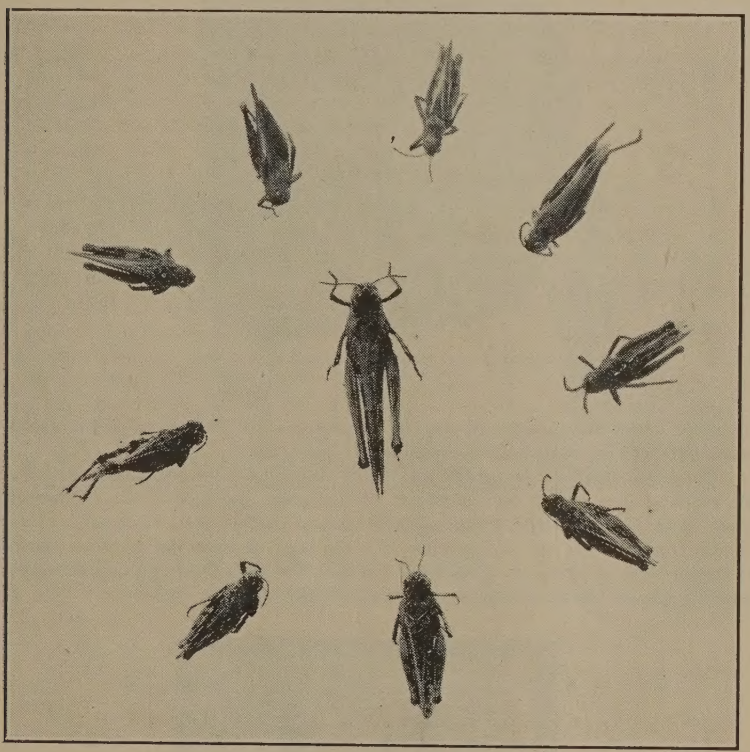


Female locust in act of laying. *a*, *a*, *a*, female in different positions, ovipositing; *b*, egg-pod extracted from ground, with the end broken open; *c*, a few eggs lying loose on the ground; *d*, *e*, show the earth partially removed, to illustrate an egg mass already in place and one being placed; *f* shows where such a mass has been coverd up. (After Riley.)

THE LIFE HISTORY OF THE LOCUST.

The eggs are laid in almost any kind of soil, so long as it is compact; hard stubble paddocks, ringbarked, ungrassed country, roadsides, sheep pads, headlands around crops, etc., are favoured places for egg deposition.

The female locust, when about to lay, selects a suitable location. By means of two pairs of hard horny valves, situated on the posterior extremity of the body, she bores a hole in the soil from 1 to 2 inches deep. These horny appliances or valves are so constructed that, when opened and shut by the muscular action of the body, they function in much the same manner as an auger. This act has been witnessed many times and been known to take up to 3 hours.



Typical ring of males as seen around egg-laying female.

[Original.]

This hole is commonly known as the egg tube. When the boring and egg-laying is in operation, the locust exudes a white frothy fluid, which, being of a sebific or oily nature, lines and caps the tube with an impervious covering, thus protecting the eggs against insect enemies, fungi, and excessive moisture. From 20 to 30 eggs are deposited in each tube, each locust being capable of laying up to 100 eggs. The eggs are laid during October-November. Owing to the dry summer which follows in those areas the eggs do not hatch until the following July, a period of 8½ months. The hoppers, when hatching, can be seen pouring out of the egg-tubes one after the other. When they reach the surface they are still encumbered with a delicate film. They remain quiet for a short period until the sun dries and cracks the film, from which they escape and at once have full use of their limbs, readily hopping about. Owing to the fact that the locusts are irregularly laying

over a period of several weeks, the young hoppers issue in what might be termed relays. The main or plague swarm, however, emerge within a week or ten days.

Section of soil showing uncapped Locust Egg Pods from which young have issued.
[Original.]

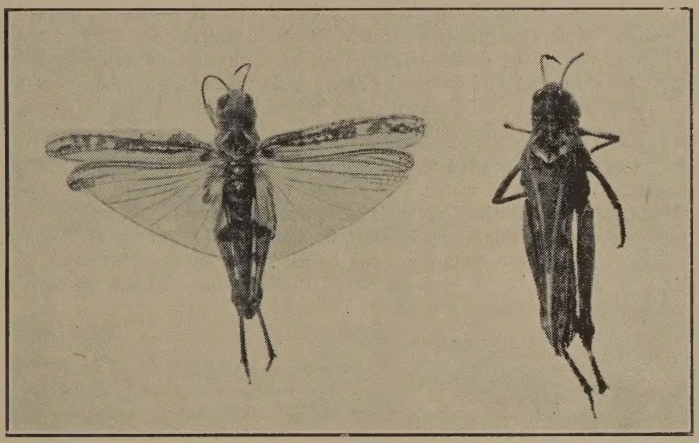
The more belated or minor swarms are too late to cause serious injury to crops or grass, but may cause damage to fruit trees, vines, etc.

The locust displays the gregarious habit from the time they hatch until death. The females when laying concentrate at certain areas and there lay their masses of eggs. It is a very important point, in the control of this pest, to observe and definitely mark the egg laying grounds with the view of breaking up such areas by ploughing or harrowing to a depth of 2 inches, for thus the egg tubes are broken, exposing the eggs to the elements, birds, and insect enemies.

Pre-winged hopper stage.
[Original.]

This work should be done as soon after egg laying as possible, before the ground becomes too hard. The earlier it is done the longer the eggs are exposed to the desiccating powers of the summer sun.

The locust after hatching from the egg goes through a series of five moults, finally appearing after the fifth moult as the winged adult. The hopper or pre-winged stage occupies about two months. The adult locust has its fore or front pair of wings of a light brown colour mottled and splashed with darker brown and clouded at the tips. The hind pair are transparent and clouded at the apex. The general colour of the insect is amber brown and the legs marked with spots or bands of chocolate brown. The antennæ or feelers on the head are short, in contra-distinction to the long thread-like antennæ of many grasshoppers.



Adult or full-grown Locust. [Original.]

The female locust measures 1½ inches from head to tip of folded wings and from wing tip to wing tip 1¾ to 1¾ inches. The males are much like the females, but smaller.

The total life history in this State is as follows:—

Egg stage 8½ months, hopper stage 2 months, winged stage 6 weeks.

CONTROL.

First and foremost, it is desirable to refrain from ring-barking forest country in locust areas years before the land can be brought under cultivation, as such ungrassed, sun-exposed land is a happy breeding ground for locusts.

Locate the egg-laying grounds and, as stated before, break up to a depth of two inches as soon as possible after eggs have been laid. The act of destroying the eggs in this way would, in itself, if systematically and co-operatively undertaken, be the cheapest, easiest, and most effective measure of locust control.

Unfortunately, the average man is prone to take the line of least resistance and action is generally deferred until disaster is threatened. This particularly applies in our attitude towards insect pests. The failure to attack the pest during its most vulnerable period often means considerably added costs and poorer results.

When a field of grain exists next to one known to be infested by young hoppers, it will often be an advantage to plough a strip between the two to act as a barrier. This will retard the advance of the insects for several days, and if a deep

wide furrow is made on the side from which the insects are advancing, this will temporarily entrap them and provide a convenient situation for killing them with poison bait.

If action of a preventive nature has not been taken, or has not proved effective, there is still much that can be done before the hoppers become winged. In previous outbreaks, the Entomological Branch of the Department of Agriculture, with the assistance of reliable farmers, carried out a series of field experiments consisting of trials with poisons, sprays, baits and dusts.

It is not necessary to detail these experiments, but it is desired to refer only to those trials which gave positive results. It was definitely demonstrated that the hoppers could readily be destroyed by spraying with a poisonous spray which acted both as a contact and internal killer. This was brought about by the fact that the poison was absorbed through the skin and breathing spiracles of the insect and also by the eating of the poisoned foliage.

The formula recommended for this purpose is 1 lb. of arsenite of soda, 2 lbs. of molasses, 16 gallons of water. This is sprayed over the hoppers, weeds and grass, resulting in the death of myriads of the young locusts. There is one definite drawback to the use of this spray in crop, in that it badly scorches the foliage, but when the scorching does not matter it can be used with excellent results. From 70 to 80 gallons of the spray is used per acre. Cattle or sheep should be kept off an area so treated for at least two weeks.

Poison baits were also experimented with; that giving the best results and recommended is composed of 1 lb. of arsenite of soda, 30 lbs. of bran, 4 lbs. of molasses or treacle, 3¼ gallons of water. The arsenite of soda is dissolved in hot water, likewise the molasses. Both are allowed to cool before being added to the balance of water, making in all 3¼ gallons of liquid. This is then added to the bran until it forms a crumbly moist mash. It is important not to make the mixture too wet. If Paris green is the poison used, mix 1 lb. with 30 lbs. of bran in the dry state, afterwards mixing with the molasses and water to the required crumbly consistency. Arsenite of soda is recommended because it is cheaper and more toxic to the locust.

Avoid mixing the bait with the hands, particularly if any cut or wound is present. The poison bait should be broadcast during the first feeding of the locusts. These insects fast all night and are not stimulated to feed until after sunrise, when the temperature of the air reaches 68 to 80 degrees. This is usually between 8 and 10 in the morning. The bait should not be put out when the temperature is below 68 or above 90 degrees, or during cloudy, windy or inclement weather. A still, bright morning is the best condition for baiting.

The hoppers after their night's fast are eager to feed, and after being warmed up by the sun they readily take the poison bait when distributed amongst them. Locusts do not die immediately they have eaten the bait. The poison may require 24 hours or even longer to become fully effective. It usually makes them sick within a few hours, however, and they do little further damage after having eaten a fatal dose.

The prepared mash should be thinly and evenly scattered over an infested field at the rate of 15 to 20 lbs. dry weight per acre, according to the number of locusts present. Every precaution should be taken to see that the bait falls apart into flakes.

Casting it into the wind with a snap of the wrist will help to accomplish this. If dealing with large quantities of bait, it can be distributed from the rear of a wagon or truck.

In the recent plagues experienced in the Eastern States a rather novel method, which has been proved definitely successful in destroying vast numbers of locusts, particularly in the hopper stage, has been evolved. In localities where sheep are available, a flock is driven over the ground where the young hoppers are concentrated, and by the action of their close treading the majority of the hoppers in their path are destroyed. Burning off, when safe, will destroy large numbers. The use of a roller where possible is advised.

Finally, let me impress upon all growers the great need for the co-operative poisoning of locusts, regardless of where they are found. A well planned campaign, started early and pushed to completion before the locusts are winged, will in most cases prevent serious crop losses; but if action is delayed in order to see what is going to happen, or until the pest is doing serious damage and on the wing flying from one field to another, failure is certain.

It is very important to remember that great and serious damage has been caused to pastures, crops and fruits in the Eastern States by the same species of locust as is herein referred to. It therefore behoves all interested to give serious consideration to the locust problem and take the necessary preventive and remedial measures before the pest appears in overwhelming plague form.

AGRICULTURAL PROBLEMS

Agriculturists, pastoralists and primary producers generally, who may be having difficulties of any kind in connection with their production activities, are invited to communicate with the Agricultural Adviser of their district of the Department of Agriculture, when information and advice will be supplied free of charge.

Where identification of plant or stock diseases or insect pests is required, full details of symptoms should be forwarded and also samples of the diseased plant, animal tissue or insect where practicable. Plant tissue intended for examination by the Plant Pathologist should be wrapped in paper and not forwarded in airtight containers, and plant specimens for the Botanist should be pressed between newspaper and dried before despatch. With regard to animal tissue for microscopic examination, this should be forwarded in a solution of 10 per cent. formalin, or if of considerable bulk in a sealed kerosene tin containing a few ounces of formalin as a preservative. Living insects should be sent in suitable containers and dead specimens in methylated spirits.

The addresses and names of Advisers are as follows:—Albany, A. C. Vaughan; Bridgetown, A. Flintoff; Bunbury, M. Cullity; Denmark, V. Cardon; Geraldton, G. L. Throssell, Government Buildings; Gosnells, R. C. Owen; Harvey, D. L. Breen (Fruit) and C. Giles (Dairying); Katanning, A. S. Wild; Manjimup, J. Ireland; Mundaring, V. Cahill; Northam, F. L. Shier; Northcliffe, A. Sharp; Vasse, J. M. Nelson.

STALLION REGISTER, 1934-35.

Registrations prior to 21st November, 1934.

*Note.—Age in years: A. aged; D. draught; Ar. arab; T. thoroughbred; Tr. trotter; P. pony.

Name.	*Age and Class.	Owner and Address.
Admiral Fyvie	A.D.	C. E. Potts, Pingelly
Ahitana Bold	8 D.	R. Snow, Wickepin
Ahitana Admiral	A.D.	G. Hatwell, Dowerin
Allandale Duplicate	4 D.	R. Carroll & Sons, York
Allendale Thunderbolt	6 D.	A. Cleland, Perenjori
Altar Star Prince	6 D.	F. W. Evans, East Kondut
Anchor	A.Ar.	A. A. Toll, Wagin
Anama Renown	7 D.	A. Sanders, Dowerin
Annandale Baron	3 D.	J. Carruthers, Lake Grace
Armada	A.D.	M. S. Fisher, Lomos
Auchen Bloom	3 D.	G. W. C. Ward, Harrismith
Auchen Pride	4 D.	J. Fitton, Moulyinning
Banker's Pride	7 D.	F. C. Simpson, Pantapin
Barney	7 D.	A. Low & Sons, Kellerberrin
Baron Banchong	5 D.	P. Strange, Yarding
Baron	7 D.	H. Johnston & Sons, Balkuling
Baron Braebank	5 D.	J. Kay, Baandee
Baron Brayton	A.D.	J. Carr, Beverley
Baron Breastknott	A.D.	F. W. Gibbs, Dinninup
Baron Caledon	8 D.	W. Johnston, Billaricay
Baron Clyde	5 D.	J. Knox, Yealering
Baron Dale	A.D.	A. W. Wilkins, Durakin
Baron Glen	7 D.	G. A. Howlett, Karlgarin
Baron Griff	3 D.	M. W. Hodgson, Dowerin
Baron Hillgrove	5 D.	C. Smith & Sons, Yarding
Baron Hillside	5 D.	R. Gault, Greenhills
Baron Lin	A.D.	M. A. Wickham, Yarloop
Baron's Prince	A.D.	E. B. Metcalf, Dowerin
Baron's Sovereign	A.D.	S. C. Gill, Kulyalling
Baron's Stamp	A.D.	R. Our, Newdegate
Baron Ward	A.D.	J. N. Ford, Narembeen
Bencubbin Bill	5 D.	H. M. & M. Growden, Quairading
Benowerie Crest	3 D.	L. M. Craig, York
Black Baron	6 D.	H. V. Boundy, Babakin
Black Prince	4 D.	Franklin & Sons, Wyola
Bloomfield Flashlock	A.D.	B. M. Connor, Toodyay
Bloomfield Sensation	5 D.	L. R. Blight, Mukinbudin
Baron Victor	3 D.	M. Lucas, Beverley
Beau Brummel	A. Tr.	R. English & Son, Wickepin
Beau Valley	2 D.	G. J. Bostock, Pingelly
Bold Everest	5 D.	A. H. Young, Aldersyde
Bold Jack	7 D.	Caffell & Finey, Tammin
Bold Major	5 D.	C. W. Heal, Quairading
Bonnie Crystal	4 D.	P. Rose, Burekup
Bonnie Vale	A.D.	R. Bungey, Borden
Bonny	A.D.	C. A. Richter, Wickepin
Boondilla Vice Roy	8 D.	H. R. Argent, Lake Grace
Border Ensign	A.D.	W. J. Faulkner, Kukerin
Boxer	4 D.	J. Lloyd, Lake Biddy
Boxer	6 D.	V. H. Francis Lane, Three Springs
Bradman	5 D.	A. F. H. Muir, Manjimup
Brilliant Day	A.D.	Yarragadee-Nalbarra Pastoral Co., Mingenew
Brilliant Starlight	6 T.	C. Draper, Duranillin

STALLION REGISTER, 1934–35—*continued.*

Name.	*Age and Class.	Owner and Address.
Brilliant Town	4 T.	Yarragadee-Nalbarra Pastoral Co., Mingenew
Broadview Winalot	6 D.	R. Carroll & Sons, York
Bruce	A.D.	T. Johnson, Yandanooka
Bruce	6 D.	Beswick Bros., Yealering
Bruce Leader	6 D.	A. W. Douglas, Woodanilling
Buchlyvie Bute	A.D.	R. Carroll & Sons, York.
Bulagin Major	6 D.	J. E. Peters, Wyalkatchem
Bullara Dale	6 D.	H. G. Johnston, Dangin
Burnside Viceroy	2 D.	R. Kirkham, Yarloop
Caledonia	5 D.	R. Carroll & Sons, York
Carlot	4 T.	Darlot Bros., Mingenew
Carngham Baron Jim	A.D.	McLarty Bros., Pinjarra
Carngham Bold	8 D.	R. James, Carnamah
Carngham Flash Dignity ...	4 D.	J. A. Stevens, Kellerberrin
Castlemaine	6 D.	J. Spackman, Wickepin
Castle Ray	5 D.	C. L. Perry, Darkan
Claphamdale	6 D.	F. W. Wright & Co., Dalwallinu
Clifton Flashdale	6 D.	J. Harrod, Kununoppin
Clyde	5 D.	S. L. E. Lange, Popanyinning
Colingrove Baron	4 D.	Murrum Pastoral Co., Goomalling
Con of Buchlyrie	A.D.	M. J. Bennett, Lake Grace
Coorara Robin	4 D.	P. E. Forrester, Southern Cross
Coorara Flash Ronald	3 D.	P. Falconer, Trayning
Craig Noble	5 D.	A. T. Zwar, Merredin
Craigie Emblem	5 D.	L. H. Lawrence, Northam
Craigwillie of Cooring	A.D.	A. J. Magee, Kulin
Cramphorne Lothian Craig ...	5 D.	W. A. McAlpine, Latham
Culloden	4 D.	J. Watkins, Wagin
Dalmeny Footstep	3 D.	A. Della, Wannamal
Dalmeny Middlerigg	3 D.	M. G. Murray, Bowgada
Dalmeny Renown	8 D.	W. Jones, Walkaway
Daliak Bute	2 D.	C. & A. Thorn, York
Don	4 D.	J. Dixon, Kellerberrin
Don McDonald	A.D.	W. Stewart, Pithara
Doon Auchencraig	4 D.	J. H. Stone, Dangin
Doon Auchen Gift	2 D.	E. Bushalla, Narrogin
Doon Loch	3 D.	G. H. White, Dinninup
Dora's Dunure	A.D.	Edgar Bros., New Norcia
Douglas Cobham	8 D.	W. Fraser, Dowerin
Duke	2 D.	E. W. Whittington, Brookton
Dunlop	3 D.	G. Goodall, Kojonup
Dunure Valley	4 D.	G. Pense, Wickepin
Earlstone	A.D.	R. T. Jenkins, Wagerup
Eastern Hero	4 D.	R. P. Wardle, Moora
Edenhope's Beauty Masterstroke	2 D.	J. H. Ferrier, Wickepin
Egyptian Idol	A.T.	F. B. Wittenoom, Toodyay
Enfield Monarch	4 D.	C. Smith & Sons, Yarding
Erindale Glengyle	4 D.	E. V. Brockman, Nannup
Eudamatch	A.T.	F. T. Carter, Tammin.
Fairfield Scottish Banker ...	6 D.	A. McD. Sargent, East Katanning.
Ferndale Briton	5 D.	A. J. Hill, Beverley
Fitregas	A.T.	J. B. Newbicup, *via* Boyup Brook
Flaming Star	6 T.	R. P. Bryant, Quairading
Flash Mac	8 D.	H. W. Treloar, Boyup Brook
Flash Willie	3 D.	H. P. Jolly, Nungarin

STALLION REGISTER, 1934-35—*continued.*

Name.	*Age and Class.	Owner and Address.
Gallantry	A.D.	C. Lawler, Wongamine
Gay Baron	4 D.	Hon. E. Rose, Bunbury
Gay Boy	3 D.	H. Weaver, Gabbin
Geordie	A.D.	R. J. McCarthy, Esperance
Glencoe Victor	3 D.	C. W. Bateman, Beverley
Glen Varloch	4 D.	C. Walker, Kukerin
Golden Image	4 D.	W. F. Penny, Greenhills
Golden Wheat	8 T.	A. E. Cockram, Belmont
Grand Newton	A.D.	D. Johnston, Greenhills
Great Scott	3 D.	W. Linto, York
Gumpark Favourite	8 D	H. G. Bolt, Woodanilling
Hagley MacGregor	4 D.	Preston & Ryan, Tammin
Heather Lad	2 D.	D. Walker, Balingup
Hillgrove King George	4 D.	E. David, Kellerberrin
Homebush Chester	6 D.	R. W. Moodie, Westonia
Homebush Sampson	5 D.	J. Rogie, Pingelly
Howqua Dale	6 D	J. O'Toole, Gnowangerup
Harold's Pride	3 D.	C. D. Williams, Boodarockin
Ideal Footstep	8 D.	A. Jones, Dowerin
Inverell Footprint	2 D.	A. Jones, Dowerin
Inverell Freestep	2 D.	A. Jones, Dowerin
Inverell Jock	2 D.	A. Jones, Dowerin
Inverell Lightstep	2 D	A. Jones, Dowerin
Inverell Satisfaction	4 D.	H. F. Cook, Tammin
Jack	4 D.	H. Hatfield, Kellerberrin
Kathleen Vale Style	4 D	W J. Pethick, Winchester
Kayanaba Don	3 D	H. P. Halligan, New Norcia
Kayanaba Pilot	3 D.	T. W. Ward, Ballaying
King Edward	A.D.	W. Sherwood, Wyalkatchem
Koojan Earl	A.D.	F. Packham, Tammin
Koojan Norval	A.D.	— French, French's Siding
Kayanaba Duke	4 D.	C. J. Roberts, Dandaragan
Laddie	3 D.	H. Beard, Jennapullen
La Fayette	A.Tr.	D. Stevenson, Moulyinning
Laddie	A.D.	F. Bussell Vines, Busselton.
Leurgen Ben Holton	4 D.	T. Wilding, Mokine
Lord Banker	6 D.	A. W. Hewton & Sons, Minnivale
Lakeside Bold Bute	8 D.	Shadbolt Bros., Mukinbudin
Longernong Dignity	6 D.	E. Williams, Northampton
Lord Charmer	7 D.	N. F. West, Wagin
Lord Pontiac	3 D.	J. A. Seaman, Greenhills
Lord Roseberry	8 D.	W. Morgan, Wagin
Lothian Hero	3 D.	J. C. Summers, Capel
Lothian Prince	6 D.	G. S. Dayman, Emu Hill
Londoun Stamp II.	6 D.	Growden Gros.. Nangeenan
Lucky	4 D.	W. J. Drage, Mt. Barker
Lyndhurst	7 D.	E. A. Ebsary, Wickepin
Lyon	3 D.	J. Longuran, Bindi Bindi
Mac	6 D.	H. W. Fitt, Narrogin
Mack	7 D.	G. E. Robins & Co., Babakin
Major	3 D.	L. R. Martin, Williams
Major Douglas	4 D.	J. Piggin, Trayning
Major Hillside	6 D.	E. K. Brown, Dumbleyung
Major Valley	A.D.	H. A. Lupton, West Beverley
Marsonius II.	4 D.	Burgin & Yeomans, Wadderin Hill
Master Celtic	A.Tr.	H. Patroni, Donnybrook

STALLION REGISTER, 1934-35—*continued.*

Name.	*Age and Class.	Owner and Address.
Max	3 D.	J. Everitt, Pantapin
Maylea Boy	3 D.	A. Jones, Dowerin
Mendie	7 T.	Benedictine Community, New Norcia
Mona Park Baron	8 D.	Wiese Bros., Highbury
Moorlands Captain	7 D.	A. V. Moore, Doodlakine
Mussolini	6 D.	E. Ludeman, Wattening
Nariel Banker	5 D.	L. J. Stacey, Quairading
Native Prince	4 D.	C. Scott, Bullfinch
Neumylda	A.T.	Penn Bros., Northampton
Newbold Enterprise	7 D.	Craike Bros., Trayning
Newfields Ambition	6 D.	C. G. & A. E. Nicholas, Gnowangerup
Newfields Sensation	4 D.	E. P. Young, Kondinin
Night Douglas	6 D.	W. J. Glen, Rivervale
Noble Lee	4 D.	W. J. Neill, Boyanup
Nonsuch Style	A.D.	T. Pauley, Wickepin
Nonsuch Style	7 D.	M. H. Erhardt, Dowerin
Oaklyn Refiner	4 D.	V. G. Rennie, Gingin
Olympian	5 T.	F. A. Farquhar, Gingin
Penryn Leader	4 D.	S. L. Folland, Coorow
Penryn Leading Dale	8 D.	E. J. Sinclair, Esperance
Perfect Hero	2 D.	R. J. Parnell, Gnowangerup
Peter Stretta	A.Tr.	Dr. A. Jewett, Perth
Peter of Triagen	6 D.	W. Potthoff, Kondinin
Peter Voyager	8 Tr.	W. Pratt, Belka
Pilot	3 D.	H. W. Langley, Brookton
Pride	7 D.	W. Mullan, Harrismith
Prince Aubry	4 D.	W. A. Wiseman, Kulja
Prince Belmont	5 Tr.	A. J. Reither, Pingelly
Prince Bold	5 D.	H. W. England, Bowgada
Prince Derby	A.Tr.	R. Carroll & Sons, York
Prince Douglas	4 D.	A. Stewart, Dowerin
Prince George	5 D.	C. H. Saw, Bow River
Prince Gilikin	4 D.	A. C. Carter, Williams
Prince Loman	4 D.	G. Fontanini, Manjimup
Prince Paladin	3 D.	S. King, Dowerin
Prince Robert	5 D.	L. Brissenden, Muntadgin
Prince Roland	3 D.	H. McCormack, Gingin
Prince Roy	A.D.	D. Hehir, Yandanooka
Prudent Beggar	A.T.	H. Evans, Perth
Punch	5 D.	T. G. & J. Maughan, Nukarni
Punch	4 D.	W. Lines, Ballidu
Punch	A.D.	F. Bishop, Three Springs
Rab	6 P.	J. Spiers, Wanneroo
Robin	A.D.	H. Hamersley, Wagin
Rob Roy	6 D.	E. A. Bates, Welbungin
Rosecombe	4 D.	F. Clifton & Son, Gwambygine
Roselock	3 D.	T. H. Leake, Kellerberrin
Rosemont	A.D.	W. K. Miller, Donnybrook
Roslyn Douglas Viceroy	A.D.	Becker Bros., Wagin
Rothesay Prince Craig	3 D.	W. G. Argent, Kulin
Rowdy	4 D.	C. Eyden, Highbury
Royal Appotenic	3 D.	A. J. Young, Kondinin
Royal Main	A.D.	W. H. Biggin, Kondinin
Royal Prince	3 D.	W. A. T. Sargent, Carnamah
Royal Star	A.D.	G. Irving, Cranbrook

STALLION REGISTER, 1934–35—*continued.*

Name.	*Age and Class.	Owner and Address.
Scheyvilleure Librarian	6 D.	J. Christie, York
Scotch Willie II.	4 D.	J. H. Price, Narembeen
Scottish Lad	3 D.	Mt. Barker Estate, Mt. Barker
Sea Crest	A.T.	L. W. Viveash, Northam
Sedalia Douglas	5 D.	T. G. McGellin, Belka
Silver Bold	5 D.	Wilhelm & Sons, Woodanilling
Silver Prince	3 D.	C. A. Sweeting, Tammin
Simpson's Earl	A.D.	W. C. Simpson, Round Hill
Sir Charles	3 D.	A. D. Jones, Latham
Sir James	A.D.	E. Vanzetti, Marchagee
Sir Walter Raleigh	5 D.	W. J. Bowers, Gingin
Some Scotch	7 D.	R. J. M. Fairclough, East Katanning
Spats	7 Tr.	Cowcher Bros., Williams
Sproxton	6 D.	Raffan Bros., Winchester
Squire Douglas	5 D.	B. Maughan, Walgoolan
Star	4 D.	D. Gunn & Son, Kellerberrin
Stockfield Satisfaction	3 D.	B. Maughan, Walgoolan
Sunday Sun	4 D.	A. Wilkinson, Aldersyde
Sunnylands Craig Fashion ...	5 D.	J. M. Young, Gwambygine
Sunnyside Alick	7 D.	Page Bros., West Pingelly
Tandarra Baron	7 D.	G. Ferrier, Mingenew
Taunton Robin Adair	4 D.	S. O. Argent, Lake Grace
Tinedale Prince	3 D.	H. Sainsbury, Ballidu
Tipperary	5 D.	R. H. Fulwood, Cunderdin
Trooper	6 D.	G. J. Butterworth, Katanning
Tynedale Kenwyn Again ...	3 D.	H. J. Wise, Katanning
United Scotch	5 D.	G. Moir, Borden
Valerano	A.T.	Benedictine Community, New Norcia
Valetta Ramon	4 D.	H. W. Creek, Corrigin
Victoria Shamrock	6 D.	S. B. Rudduck, Coorow
Victory Star	4 D.	G. W. Smith, Corrigin
Wallad	5 A.	C. C. Readhead, Walkaway
War Dance II.	5 D.	P. Briotti, Koorda
War Dance III.	3 D.	Ferguson Bros., Koorda
War Dolan...	6 D.	M. E. Millar, Mandiga
War General	6 D.	C. A. Sweeting, Tammin
Wattle Grove Gaylad	7 D.	A. M. Day, Burracoppin
Wattle Valley Bold Boy ...	3 D.	E. A. Ebsary, Wickepin
Wattle Valley Rosemont Again ...	6 D.	J. Franks, Lake Grace
Wattle Valley Stamp	A.D.	H. G. Ebsary, Wickepin
Wee Laddie	5 D.	G. Petchell, Williams
Wendourie Auchenflower ...	4 D.	P. J. Collins, Tambellup.
Werndew Flashlight	6 D.	J. Carruthers, Lake Grace
Werndew Squire	3 D.	H. W. Biglin, Kondinin
Werrap Pride	3 D.	L. C. Cusbert, Bruce Rock
West Wimmera	6 D.	W. G. Hallam, Red Lake
Widgie	3 D.	G. L. Weaver, Beverley
Widgiewa Pilot	A.D.	R. Ditchburn & Sons, Kukerin
Widgiewa Pete	2 D.	W. T. Hobbs, Beverley
Wimmera Cavalier	3 D.	Benedictine Community, New Norcia
Woolamia Mark	2 D.	J. & H. B. Rinaldi, Kalannie
Woolie	A.D.	J. Thomson, Donnybrook
Wrayton Mark	2 D.	J. E. Bates, Boddington
Yadlock	2 T.	D. C. Pearce, Kojonup
Yodelist	A.T	H. H. Roberts, Capel

* Note.—Age in years—A. Aged ; D. Draught ; Ar. Arab ; T. Thoroughbred ; Tr. Trotter ; P. Pony.

OLIVE YOLKS.

G. D. Shaw, Poultry Adviser, Department of Agriculture.

"Olive" Yolk or "Olive Coloured" Yolk, which has been prevalent and increasing in Western Australia for the last six years, is causing considerable concern in the poultry industry.

Literature from the world's experimental stations states the cause as the feeding of greens containing pigment.

While admitting that a yolk can be coloured by feeding a diet rich in pigment, the writer considers there are two distinct "olive" yolks, classified into:—

1. "Olive coloured" yolk.
2. "Olive yolk" or diseased yolk.

The first is caused by feeding excessively on a green diet rich in pigment, and when the egg is laid it is coloured and "candles" distinctly olive.

Eggs of the second class when laid are normal in colour, but when kept in normal spring or summer temperatures over a period of four to six weeks gradually develop a yolk which is definitely green, with a thickening, showing corrugations over the surface. These eggs when seen under the candling immediately after being laid are normal, but when five days old show the same colour as an "olive coloured" yolk.

In order to differentiate between an "olive coloured" yolk and an "olive yolk" or diseased yolk, on a candling floor, it is necessary to keep the eggs about 14 days; an "olive coloured" yolk does not change colour, and can then be separated from an "olive yolk" because the latter has developed a deeper colour.

How to tell an "Olive Yolk" (diseased) or "Olive Coloured" Yolk under the lights.

When looking through an egg the normal yolk shows no tint at all, but with a diseased yolk one sees just the faint semblance of grey tint incorporated. This tint is similar to one obtained if a drop of black ink had been stirred into the yolk. As the egg ages, the grey deepens until the orange of the yolk has been replaced by a deep grey colour. When the grey predominates over the orange colour, the egg is found to be unsightly on breaking.

The "olive coloured" yolk is laid "olive," and is easily discerned as a grey yolk, but when broken is normal except for a very light greenish tint in the yolk and *white*.

At the normal period of marketing, between four to seven days, it is impossible to separate the "olive yolk" from the "olive coloured" yolk, owing to the progress made by the diseased egg.

Lines of Information.

During the export season of 1933, the writer was in a position to observe this phenomena closely. It was found that the trouble in most country districts gave support to excessive green feed pigment theory, but it was noticed to occur on a farm owned by the writer, at a time when, owing to lack of facilities at the moment, no green feed was being fed.

This led to a new line of thought and investigation.

Knowing the condition of the flock when the farm was purchased, further symptoms were sought, and trap-nesting and culling experiments were undertaken. The "olive yolk" laying birds—obviously weak-constitutioned specimens—were culled, thereby eliminating "olive yolk" from the market returns.

Several farmers in the country, who were marketing "olive yolks," were advised to tone up their stock, and this had a marked effect, but the result was not conclusive, because the season of "olive yolks" passed before the treatment could be continued. Also it was found more prevalent in eggs marketed once a week than in those lines marketed more frequently.

Experiments conducted to ascertain the result on Condition of the Egg after Candling.

An excellent candler (one who could discern the "olive yolk" in its infancy) was requested to report all lines showing that defect. These eggs were divided into four lots, two being placed in cool store, and two left out under normal conditions.

Cool Store Section.—Did not develop, but were held in suspense.

Normal Section.—These eggs in some cases developed to a dark green, and in others stayed the condition as when candled.

It was then decided to ascertain the position when kept in cool store for periods of three months and six months. Four cases, each containing 25 dozen eggs, were placed in cool store at 35deg. in October, 1933, and examined periodically. No change was noted, and, on 11th May, 1934, the cases were withdrawn and candled by myself. No change had taken place; the colour had not deepened.

Two dozen of these eggs were then taken to the Department of Agriculture and left in normal conditions, with the result that part of the two dozen developed to a dark green as before mentioned.

Effect on Whites of Eggs showing "Olive Yolk."

Ten lbs. of "whites" were made from eggs showing either "olive coloured" yolk or "olive yolk." Ten lbs. of whites were made from normal yolk. Both lots were placed in cool store and after three months taken out and treated in a manner similar to that required by a pastrycook, *i.e.*, thawed, and a quantity taken out, the remainder again frozen: thawed again, and again frozen until both lots became sour. No difference in quality could be found, which leads one to the conclusion that the whites are not affected by the disease of the yolk.

Experiments with Pulp.

40 lbs. pulp from normal yolks as a control, and

40 lbs. pulp from "olive yolk" or "olive coloured yolk."

These were treated as were the whites, the effect being that the "olive coloured" pulp went a blackish colour, while the normal pulp went sour, the sourness in both cases being put down to the fact that the continued application of thawing caused fermentation.

Other Results.

Some eggs which have been candled for local consupmtion have (in the retailers' shops) gone bad, and on investigation have proved to be the diseased "olive yolk" (of course we are not considering the dead germ of a fertile egg)

In 1933 seven chicks were hatched from "olive yolks" marketed from the country, but unfortunately in April 1934 heavy rain drowned them. It was intended to observe their laying and condition when laying.

Last September (1934), eggs sold after being candled developed to the green stage three weeks later.

General.

These defects occur during the period of excellent green feed growth, *i.e.*, in the spring, but it should also be understood that the weak constitutioned bird also lays at this period.

The disease in the egg also disappears as the grass dies away, but the weak constitutioned layer also stops laying at this time.

It appears that the two are combined in season, and this makes it extremely hard to continue with experiments. It is also noticed that eggs from the farms of men who "cull" heavily do not contain the "olive yolk" and that those who do not "cull," *i.e.*, the newcomers to the industry, contain high proportions; as high as 80 per cent. has been seen. I have been called to "cull out" farms, and when cleaned up the owners have had no "olive yolk" in their market consignments until a further weakness has developed in the flock.

The results have led to a belief that the cause of "olive yolk" is inherent in all birds, but can only develop in a weak constitutioned one, and as a farmer should not tolerate that class of bird on his farm, it should eventually be kept in check and entirely eliminated.

It must be understood that although the heavily "culled" farm does not market the "olive yolk," it may be present in the flock, but is kept in control.

POULTRY FARMING FOR THE BEGINNER.

(*Continued.*)

G. D. Shaw,

Poultry Adviser, Department of Agriculture.

Pullets are in their best laying condition when they are well grown, completely feathered, and in the best of health. At this stage they should handle "heavy" with the feathers giving a feeling of "tightness" to the body. We have been handling our stock now for five months and should recognise body, size, shape and stamina; without all these the bird is sure to break down sooner or later.

When handling a good bird, no matter of what breed, look for body proportion. A well proportioned bird is one that measures in proportion of 1 in depth, 1 across the back, and 1½ along the back from where the neck joins the body to just in front of the tail. Any definite variation from these figures will place a bird out of proportion. Length, breadth and depth give us a well proportioned bird which can be well balanced and have a good capacity for producing eggs.

The pullets at this stage should be carrying a little fat at the abdomen, not too much, but certainly easily discernible when handled. In handling, the good bold eye and intelligent face must not be forgotten.

At this stage, care should be exercised in the methods of feeding. It is at times advocated that when the birds start laying they should be placed on a laying mash, and while in agreement with this statement, the meaning of a layer's mash must be understood.

Up to this stage feeding has been for growth in order to give the pullets a chance of carrying on through a laying season without check, and here the farmer is advised to consider whether all the eggs are to be obtained during the first year or over a longer period.

It has already been mentioned that the pullet is born into the world with the one object of reproducing her species, and we must cultivate that objective. It must not be thought that eggs mean chicks. More often than not, it means no chicks. The pullet must be nursed for twelve months. It is not reasonable to force for egg production in her first year and then expect plenty of strong, healthy chickens during her second season. If a pullet is fed for stamina and growth, she will give of her best during both years.

The practice to-day is to force the pullet to take a rest after her first laying season before asking her to produce eggs which will produce hardy, easily reared chicks. To follow that practice, those pullets must not be placed on a layer's ration, but still continue to be fed for growth—the eggs will come naturally.

A layer's ration is one which is fed when the advisability of disposing of the birds at the moment they cease to produce is being considered, and its use is to force egg production during the birds' last season on the farm.

Keep the pullets on a grower's ration.

Milk.

The value of milk has not been considered up to this point.

Milk—separated, skim, or dried buttermilk— is a most valuable addtion to all poultry feeding. The chicks thrive on it and the growing stock also. Most farmers have their own household cow, and it is advisable to feed all the milk one can afford to the young stock. In fact, if skim or separated milk is not obtainable, dried buttermilk is easily procured and is a valuable food.

The baby chicks can be left to consume as much skim or separated milk as they can, but care should be taken that it is fed either fresh only or sour only. If fresh is alternated with sour, bowel troubles can be anticipated, because the young stock are not strong enough to manage the change.

A 5 per cent. addition of dried buttermilk is the proportion required for stock.

Until the butterfats have been separated, do not give the milk under any consideration.

A word of warning is necessary at this stage. It has been considered that the protein content of the milk can take the place of the protein content of the meatmeal. It can, within limits, but it must not be forgotten that separated and skim milk contain a proportion of water and as such we must be careful that 10 lbs. of meatmeal are not replaced with 10 lbs. of milk. Consider the solid content only and when reducing the meatmeal do so only in proportion to the solid content of the milk. Experience encourages the belief that the addition of milk to a ration without reducing the other proteins is not harmful. In fact, it is an advantage, overcoming the danger of feeding less protein than would otherwise be the case, when the solid content of the milk is not known.

When a pullet starts to lay, it has a double function to perform; that of manufacturing eggs and at the same time replacing wasted tissue. The strain must be enormous and we must be prepared to meet that strain by careful management.

This is where handling becomes so necessary, and what better procedure than by handling during the process of trapnesting?

Trapnests.

A trapnest is a nest which has a front to it so arranged that on the bird entering the nest the front is released, thereby imprisoning the bird until the attendant has registered the number and egg.

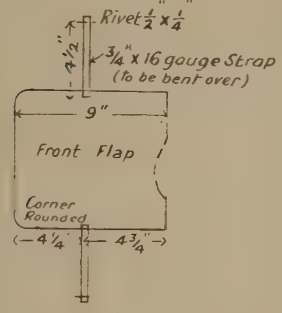


FIG 1

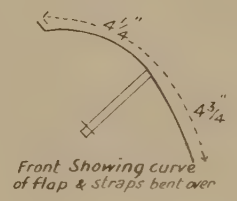


FIG 2

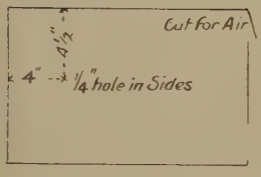


FIG 4

FIG 3

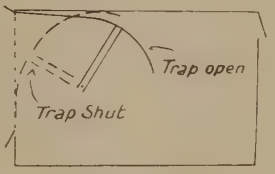


FIG 5

One sheet of 36in. x 22in. P.G. iron, cut into pieces 9in. x 8in., will make 36 nest flaps for kerosene tins (Fig. 1). Two pieces, each 5in. x ¾in., 16 gauge galvanised straps are required for arms; two galvanised rivets for pins, ½in. x ¼in., at end of arms; two smaller rivets to join arms to flap. The tin is cut out in front (Fig. 3), leaving ledge 2¼in. in tin, and cut at the top rear for ventilation. Two holes, ¾in. in diameter, are punched in the sides near the front 4½in. from top and 4in. from front (where the ½in. x ¾in. rivets turn) (Fig. 4). The arms are riveted to flaps and then bent downwards (Fig. 2). The natural spring in the arms allows pins to fit into holes in the sides without releasing. The flap is curved (Fig. 2) so that it swings clear of top of tin, at the same time not falling inwards. The rounded end (Fig. 1) is at the rear and the other end is cut out to lighten it. Outer end is turned outwards; this rests against top of tin when nest is open. The front is the important part. Measurements given are for front for kerosene tin. If other size boxes are used all measurements to be adjusted in proportion, i.e., if front of nest is 12in. x 12in., all measurements will be multiplied by fourth-thirds of those given.

A kerosene tin has been found satisfactory for both heavy and light breeds.

Each pullet has been branded with a red celluloid embossed or numbered brand. It will be noticed that the pullet on first entering the nest is extremely timid and will have a tendency to break the eggs in its struggles to obtain release. As the pullet will enter the nest days before the first egg is laid, the attendant has an opportunity of obtaining the bird's confidence. When releasing the bird, handle it gently, stroke it along the back, and then place it gently on the floor of the shed. (Do not drop it.) Stroke it again and then release. After three or four days the bird will be responding to the treatment, and the tendency to rush about the nest after laying is reduced.

They soon settle down to their work in peace and quietness, and the trapping is a pleasure. Each bird will wait until the front is lifted and walk calmly into the attendant's hands.

A good trapnesting record sheet is illustrated.

TRAPNEST RECORD SHEET.

Pen No.: Month :

Days of the Month.

Bird No.	Breeding.	1	2	3	4	5	6	7	8	9	10	Up to 31.	Month Total.	Grand Total.	Remarks.
Total, per day															

Contrary to statements made by those who have never installed trapnests that it entails extra work, one might instance the advantages obtained which are direct and recorded immediately.

The handling is positive. Each day the condition of the birds is noticed. The eggs are 99 per cent clean this saves that time which would otherwise be taken up in washing the eggs.

Culling is automatic.

There is no danger of a bird being sick without its being immediately noticed, and breeding, instead of being a game of chance, is definite in its improvement.

The bird which must lay anywhere except in the nests will cause worry. She is not worth persevering with, so put her in the yards which are not being registered.

On the average farm where one is always building, the act of releasing the trapnests is only a break in the otherwise tedious work. Most objections to trapping seem to be on the score of the constant attention required, but should no attendant be employed and should all wish to be away one day, no harm is done by taking the fronts off the nests for that day and ruling a line down that day's register.

Trapnesting is the only positive means of testing the production of the pullets on the farm. It fascinates the operator and it provides that degree of certainty when selecting birds for breeding purposes which is entirely absent in any other modes of selection.

The pullets, having been fed and managed for growth and vitality, are straining to lay, and when they do so, do not be surprised at a fair number of double-yolked eggs. This can be understood as the stock are in a condition where the yolks are ripening faster than they can be shelled. Little notice need be taken unless they persist in that practice, then look to your feeding: it is too forcing.

The pullets, after a large egg or two, will settle down to steady production. The pullet which lays consistently with a break of one day in four or five is the one which should be cultivated.

Marketing.

It is of little use producing good-sized eggs if our system of marketing is at fault. The prevailing pack in Western Australia is the kerosene case, a size of package which can accommodate 25 dozen 2-ounce eggs.

There are two ways of forwarding eggs to market:—

(a) In chaff.

(b) In fillers.

Packing in chaff has been most popular in past years, but is being replaced by the filler method. Each has its advantages and disadvantages.

Chaff for packing eggs must be of the best quality. It is fatal to use mouldy or tainted chaff. The practice of producing good-quality eggs, then packing them in poor, mouldy chaff, causes untold losses to the producer. If your produce is good see that it reaches its destination in that good condition. A mouldy chaff or even one that has a faint taint imparts that taint to the eggs, and so lowers their quality. An alert buyer will not tolerate a tainted parcel of eggs, except at a low value.

Country producers should have no excuse for using other than good clean chaff. The metropolitan producer can also obtain good clean chaff either from the produce merchant or the flour mills.

Packing in fillers is a recent innovation in Western Australia. One can obtain fillers and flats for kerosene cases at nominal cost from the marketing agents. These are replaced in each consignment received and renewed when necessary. A small fee per case is charged for renewal.

Grades.—In Western Australia an Agricultural Products Act which, by its regulations, controls the marketing of eggs in shell, is in operation.

Its main provisions are:—

(1) The top layer must be a fair sample of layers beneath;

(2) The eggs must be graded for size and quality;

(3) The case or package must have grower's name and address;

(4) The eggs must be clean;

(5) The grade of egg and number contained therein must be on the case or package.

(6) The grades are, New Laid, Fresh, Cooking and Stale.

(7) The sizes are:—Standard—not less than 1⅞ ozs. in weight; pullet—less than 1⅞ ozs. in weight.

(8) Cool Store and/or preserved eggs must be individually stamped "chilled" or "preserved" with an approved stamp and an approved indelible ink.

Quality.

By "new laid" is meant an egg which reaches the marketing floor within seven days after the egg is laid.

A fresh egg is one under 14 days old.

A cooking egg is one between 14 and 21 days.

A stale egg is over 21 days old and in this grade are classed all eggs which have faults which cause them to be unfit for human consumption—this grade of egg is destroyed.

The necessity of collecting twice daily and forwarding to market at least twice weekly is therefore obvious.

In order to keep your quality in No. 1 grade, it is also necessary to look for and eliminate other possible faults. By collecting twice daily and wiping where necessary with a damp (not wet) cloth, any dirt is easily removed before the egg is permanently stained. The natural warmth contained in the egg is helpful in the drying process and eggs can be packed almost as soon as wiped.

It certainly develops a routine, and a routine is necessary where eggs are concerned. Nothing is more tedious than the work necessary to clean and pack the accumulation of two or three days' eggs.

Under quality must be discussed that abominable practice of having cock birds continually running with the hens. Nothing defeats quality more than the fertilised egg and nothing reduces consumption greater than the fertile egg gone bad.

It may be a controversial subject, but under present conditions it has been decided that the male bird is not necessary for maximum production of eggs.

The male is certainly necessary on a farm which intends to breed its yearly requirements of chicks, but at that period only should he be at liberty to mate. Keep the male away from the laying birds at all times, but more especially during the late spring and summer months.

In order to produce the chick, a uniform temperature of 103 degrees for a period of three weeks is necessary to incubate the chick. After a fertile egg is laid and providing the incubating temperature is not applied, the germ action is held in suspense.

Should the weather temperature be at 80-90 degrees consistently for 6 to 10 hours, the germ starts to develop and unless the incubating temperature of 103 degrees is reached and continued for three weeks, that germ dies and the egg will go bad.

This is what is happening in most of the consignments arriving on the market during the late spring and summer months, a happening which causes low prices for eggs from both country and metropolitan producers unless the consignments are marked "Guaranteed Infertile" or the producer is known to be a farmer who has his birds separated.

An infertile egg, because it does not contain life, never goes bad. It will certainly become watery, then break down, and eventually dry up, but never reaches the state of a putrid mess.

It is surprising how one bad egg in a consignment affects consumption. It is generally the bad egg which is first broken by the housewife and the remaining eleven are allowed to go bad through lack of use.

Keep the sexes apart.

If a strange nest is found do not take it for granted that the eggs contained therein are fresh. If the means are available candle them, if not, keep them for your own consumption.

A producer who can always be relied upon to market a good new laid infertile egg is the one whose eggs (no matter how bad the sale) are the first to be sold and then usually at a higher price than others.

Perseverance on the market with good eggs is necessary before a position in the buyers' confidence is attained. It is hard to get and when you do get it, keep it. A good name is easily lost, if bad practices are allowed to creep in.

When packing in chaff, place at least 2 inches of chaff in the bottom of the case. Pack the eggs inclining at an angle of 45 degrees and do not try to pack too closely. One must remember that those eggs must be handled again for resale to consumers and if any difficulty is experienced in unpacking, it generally means broken eggs with the usual condemnation of weak shells when really it is close packing. There should be at least some chaff between each egg and also between the egg and the side of the box.

When the layer is packed, gently vibrate the box to and fro then place a layer of chaff half an inch deep on the eggs and again vibrate them and then more chaff to fully cover the eggs. Continue with each layer in the same way until case is filled.

If eggs must travel any distance by rail or motor transport, never try to pack more than 20 dozen eggs in each kerosene case and always have a cushion of chaff covering the top layer of eggs.

Fillers.

When packing in fillers, it must be remembered that the buyer has little chance of examining any but those eggs on the top layer, and be careful to see that the layer exposed is a fair sample of all layers beneath. Here it might be mentioned trouble is found in the packing. Many packers *do not* put a thick cushion beneath the bottom layer. In most cases all one finds is a flat bearing on timber (and timber none too thick at that). When the eggs are dropped into the fillers, the contact with the bottom is such that in a lot of cases a cracked egg is the result.

Long eggs also have the habit of supporting the egg above them, but not before the uppermost egg has dented the shell of the long egg below. Long eggs should be placed in the corners or at the edges.

With a deep cushion under the bottom flat, by keeping out all long or "fat" eggs one can reduce cracks, but no effort should be made to pack 25 dozen in a kerosene case. The maximum then is 20 10/12ths dozen which is five layers of 4 2/12ths dozen each layer. This leaves a space for a deep cushion over the top layer.

Owing to the careless way in which eggs are placed in filler packs, the buyers are not too confident when purchasing eggs in those packs. A little more care in handling would help to gain the buyers' confidence and so enhance the price of the produce.

Faults in Eggs for Local Consumption.

When consigning eggs for local consumption they must be fresh, sound and clean. Troubles such as the fertile egg going bad, the blood spot and staleness are occurring.

Birds having accidents to the ovary or oviduct might continuously lay "blood spotted" eggs. Should this be brought to your notice, trapnests make it easy to eliminate the faults.

Thin shelled eggs are a trouble generally caused by a shortage of shell-forming material—shell grit or bonemeal—and can easily be overcome by additional bonemeal to the ration.

Because there is shell grit in abundance before the pullets, it cannot be guaranteed that the eggs are properly shelled and the addition of bonemeal may not overcome the trouble. It may be deeper seated than that. Perhaps the birds cannot use the grit and bonemeal given to them and only by a general toning up of the system can they function properly.

Where one or two birds only are laying thin shells, do not attempt to alter the ration, rather eliminate the birds. It is only when a *flock* shows a tendency for thin shells that it is necessary to treat generally.

Diseases.

Sickness may be expected during the next three months, and heat waves coupled with the cool changes will cause concern for the health of the flock. It is of little use waiting until disease is present, but every effort should be made to prevent what can be reasonably expected.

Vertigo, colds, catarrh, roup in all its forms, bronchitis, and pneumonia, are always present during changeable weather and must be seriously combated in the preventive stage.

A heat wave is generally followed by a cool change, and chills developing into colds, catarrh, roup, bronchitis and pneumonia may be expected. As a preventive, dose the drinking water with permanganate of potash (Condy's crystals) until it is a deep claret colour. Do this daily, at the same time covering the water with a thin film of kerosene. The kerosene will kill any germs left by an affected bird.

It is well known that a sick fowl always consumes a vast amount of water. Excessive body temperature necessitates this and our aim should be to keep that sick fowl from contaminating the drinking water partaken of by a bird in good health. Hence a water trough three (3) feet above the floor on the ledge containing the nests is recommended. Only a bird in good health can reach it and the sick bird is generally beneath looking upwards to where the water is located. It is then easily noticed and doctored early in the progress of its particular ailment.

Vertigo may be caused by hereditary influence, overfeeding, excessive heat or great excitement. It is common with birds kept in confinement. Birds throw the head forward in a tremulous manner and then falter in gait. They are helpless in an advanced stage. Often birds are found dead in the nest and during heat waves it is advisable to take away the trapnests for that period, yet at the same time frequently clear the nests.

Remedy the defects and keep the bird in the shade; administer a 4-grain dose of sodium bromide every second day. Plenty of Epsom salts should be placed in the water. During heat waves dampen the scratching litter before the heat is at its maximum. Over-fat birds are very susceptible to heat and generally succumb.

Colds and Nasal Catarrh.—The symptoms are running at the nostrils and eyes. It is easily seen by looking for dirty feathers in the neck hackle caused by the bird having a tendency to bury the head round under the wing. It may disappear without treatment early or again develop into one or the other more drastic respiratory ailments.

Syringe out the nostrils with peroxide of hydrogen, place one drop of 5 per cent. argyrol in each eye, and isolate all infected birds. One dose is usually sufficient.

For individual treatment give one (1) grain sulphate of quinine pill per bird.

Bronchitis—Symptoms.—Rapid breathing and a wheezy noise when held close to the ear. The comb and wattles often turn a bluish colour. This colour is due to insufficient oxygen owing to laboured breathing. The causes are exposure, damp quarters, stuffy housing.

Should the birds have an epidemic of bronchitis look to the cause and eliminate it. Individual treatment is laborious, so flock treatment should be resorted to. Give one teaspoonful of tincture of aconite to each 60 birds daily in the water or milk which mixes the wet mash; continue until trouble abates. Twelve (12) drops

of spirits of turpentine in a teaspoonful of olive oil has been found helpful. If it is desired to apply aconite individually, the dose is one (1) drop to a teaspoonful of water daily.

Pneumonia.—Pneumonia is inflammation of the lungs. A cure is difficult as the disease is only evident on post mortem observation. Generally the bird is dead before the disease is suspected. Whenever one notices a bluish comb look for lung trouble. It generally denotes that the bird is not getting sufficient air and may be caused by an obstruction in the windpipe, caused mostly by canker, or may be either bronchitis or pneumonia. A bird dying of pneumonia is often apparently well one day, but dead the next morning under the perches with blood showing in the mouth. Remedy the cause, which will generally be damp and draughty houses or changeable weather ailing a bird which has been forced to sleep in a stuffy house.

Roup.—The first symptom of roup is really chickenpox or fowlpox. It would pay all poultrykeepers to visit their houses after dark. On going along the birds, if one finds a hen "winking," which is an unnatural procedure in a bird, one can be sure that chickenpox (the forerunner of roup) is coming. At this stage it is easily dealt with.

Obtain sixpennyworth of oxide of zinc: the same bulk in flowers of sulphur: mix together with olive oil and lard to a creamy paste. This ointment applied to the affected part of the bird, which will be the eye in this case, is a certain cure.

Should the birds be "running" at the nose, the disease has got a deeper hold. If the bird is worth keeping, syringe the nostrils out with peroxide of hydrogen, using an eye dropper but making extreme pressure when syringing. This will clear out the nostril. The next stage will be "running" eye and cankerous growth in the mouth. At this stage, it is hardly worth while persevering with individual birds. These birds may be eaten: it would pay to kill them all, but they may be treated.

Lift the cankerous growths with a sharp stick and paint the affected spot with perchloride of iron, taking care that none drops down the throat. Sometimes the cankerous growth is in the windpipe. The pipe must be cleared. This is done with a pointed stick, the bird coughing during the operation.

Bleeding must be avoided, and by painting with perchloride of iron the disease will be arrested.

Any further complication cannot be dealt with. The bird will usually die before the operator can do anything. On no poultry farm, well managed, should roup get beyond the chickenpox stage. If fowlpox only is prevalent, the treatment with the ointment before mentioned should be effective.

Any eye trouble should be treated by placing one drop of 10 per cent. argyrol in each eye, night and morning, and should one notice the "winking" symptoms, it would be advisable after treatment with the ointment to put argyrol in each eye.

Roup affects the birds during changeable weather, and in order to prevent its inroads, farmers are advised to treat the water with permanganate of potash to the colour of a deep claret and at the same time put enough kerosene on top of the water to wholly cover it with a film. This treatment, started early in March and carried through until the end of May will overcome most of the trouble of roup.

Bumblefoot, a disease caused by bacterial infection setting up an inflammation in the foot producing more or less hard and painful lumpy swellings, causing lameness, may be found.

Do not lance the swelling until it is ripe, then do so on the uppermost part of the foot. Squeeze out the cheesy matter, and syringe out the cavity with a weak solution of iodine: bandage the wound, or bed the bird on clean straw.

Sometimes the swelling comes to a head, which can be squeezed out cleanly and no further treatment is necessary.

We should now be well prepared for the following few months. Pay strict attention to the water supply and shell grit and look to the housing for vermin. Expect trouble from four sources, red mite, depluming lice, feather lice, and tick.

RED MITE.

This little mite causes enormous losses to the poultry keeper. It is not easily noticed until a pronounced drop in egg production informs the attendant that something is wrong.

The normal colour of the mite is grey but when gorged with blood it is a bright blood red. They live in crevices under perches and nests and at night swarm out and crowd on the bird's body. They suck blood until gorged and before daybreak are hidden away. During hot weather they multiply rapidly and can cause great loss to the farm. They are very small and hard to see but in clusters can easily be recognised.

Every crack and crevice about the house and all perches and woodwork should be treated with "Flezol" by spraying or painting. Do this at regular intervals.

Do not confound this mite with the red-legged earth mite.

DEPLUMING MITE.

Depluming mite or itch mite is another cause of loss. This mite is very small and cannot be seen by the naked eye. It saps the feather at its root and evidence of its presence is noted when fowls show a bareness at the abdomen, accompanied by a reddish skin generally called "sunburn" by the beginner. Depluming mite can go right through a flock of birds and besides being a cause of feather eating among the birds, is unsightly and an irritant. Clean it out by rubbing over the affected parts any vegetable or animal oil: this will immediately effect a cure.

FEATHER LICE.

There are several varieties of feather lice, but for the purpose of this article they will not be discussed in detail.

These lice invade the feathers of the bird and the noticeable symptom is a bird raking the feathers during the day. By examining the bird one can see these lice running on the skin between the feathers, most prevalent just above the vent. Several cases of heavily infested birds have brought to our notice a skin trouble which disappeared with the eradication of the lice. In all cases the birds were importations from other States.

It is a trouble very easy to remedy. Sulphate of nicotine or black leaf 40 when placed on the perches immediately before roosting time will give instantaneous relief. The fumes arising from the nicotine invade the feathers and kill the lice. Only a thin line of the nicotine is required.

TICK.

One should say that in Western Australia this is the most drastic parasite on poultry. Its damage is not noticed until the birds become extremely weak, showing a greenish diarrhoea, but once the general history of its life cycle and habit is known it is easy to eradicate. Its tenacity to life is amazing. Cases have been known where adult tick have lived without food for years. The preferred hosts are fowls and turkeys, although geese, ducks, and pigeons also are attacked.

The amount of blood they draw from the fowls is enormous, but the worst feature associated with tick is the loss caused by their being the agent through which tick fever is spread. This fever is due to the tick being infested with a microbe which is in no way detrimental to it, but when the tick are feeding this microbe makes its way, through the punctures caused when feeding, into the body of the birds, inoculating them with spirochaetosis, or tick fever.

The life cycle from the egg is roughly as follows: The female may lay many lots of eggs, each laying being followed by an engorgement of blood. The average laying is near 600 eggs. On hatching the seed tick crawl on to the fowls and attach themselves in clusters on the birds, usually on the breast and under the wings. They then gorge themselves with blood and within 3 to 5 days fall from the host and search for a suitable hiding place. From then on they feed only at night, returning to their hiding places at daylight.

The adult tick vary from one-fifth of an inch to three-eighths of an inch in size. During hot, dry weather they develop quickly, but during cold spells they are inactive. They are hard to destroy once they obtain a hold in a farmyard.

As they only emerge at night the tick are seldom suspected but their possible presence should always be uppermost in the mind of every poultry farmer.

The periodical cleaning of the sheds and perches and a close examination of all cracks will help to determine the presence of tick before any disastrous results have been felt.

The easiest method of tackling the trouble is to saturate all cracks with Flezol when building and paint all woodwork periodically, taking care that any trees having open bark are also treated. When tick have a hold it is necessary to keep sheds thoroughly clean of manure. Wedge open all joints and spray the Flezol between each joint and crack, spraying from both sides. See that all woodwork is saturated and do not forget the laps in the corrugated iron.

Repeat that treatment at fortnightly intervals and the trouble from tick will abate.

Symptoms in a fowl yard are dullness, prostration, ruffled feathers, lack of appetite, rapid wasting, dirty green and yellow diarrhoea and pale combs.

Fowls that have recovered from an attack of tick fever are then immune, giving the owner a false sense of security. These birds if still housed in a tick infested house suffer the drainage of blood which causes a loss of eggs but show no other marked effects.

Should the owner introduce birds from a clean farm it is most noticeable that the new birds are immediately stricken down with fever and die within a day or two. Such a happening is about the surest sign of the presence of tick, but in too many cases the previous owner of the dead birds has been blamed for disposing of sick stock.

Always have a rag tied round the perch or perches, and frequently examine the rag for tick.

We should now be well armed for the summer months.

MY HORSE IS SICK—WHAT SHALL I DO?

J. F. Filmer, B.V.Sc.,

Senior Veterinary Surgeon, Department of Agriculture

There is a time honoured legend that the following letter was received by a Government Veterinary Surgeon. "Dear Sir, My horse is sick, what shall I do? I trust you will be able to reply by return mail as I am very worried. Yours faithfully, John Smith." Now though this story is firmly believed in all State veterinary departments, and may even be true, the writer has not personally seen a letter worded in exactly this way, but on numerous occasions has painfully deciphered several pages of writing almost as bad as his own, without gaining any further information than that contained in the legendary epistle. The farmer eventually receives the following epistle:—"Mr. John Smith—Dear Sir, In reply to your letter undated, asking for advice concerning the treatment of a sick horse, I have to advise that, unfortunately, the data supplied by you is not sufficient to enable an accurate diagnosis to be made, and I regret that it is therefore impossible to advise you as to treatment. I shall, however, feel obliged if you will forward further details as to symptoms so that I may be in a position to advise you. Yours faithfully, Tom Brown, Government Veterinary Surgeon."

Now I have never been present when a farmer received such a letter, but imagine that after exhausting his rather extensive vocabularly he asks the question, "Now just what do these vets. want, anyhow?" It is the intention of this article to try to answer that question, and to indicate what particulars stock owners should give, when writing to ask for advice about sick animals.

Disease has been well defined as any departure from normal health. This definition indicates very well the type of information that is required for the diagnosis of disease, and it is diagnosis that is the difficult part. Once a correct diagnosis is made, in most diseases, the selection of the best course of treatment is relatively easy. Just a word of warning here. Be very careful about making your own diagnosis. Remember if you write and say "my horse is suffering from inflammation of the kidneys," the veterinary surgeon has no alternative but to prescribe the appropriate treatment for that disease. If your diagonsis is correct, well and good, but if it is wrong then the treatment may prove not only useless but harmful. Remember that diagnosis is notoriously difficult, and unless you are absolutely sure, it is always wiser to send full particulars and let the veterinary surgeon make the diagnosis.

Now, if disease is any departure from normal health, the first thing that is necessary to know is what the animal is like when in normal health, so start your letter with a very careful description of the animal. Give the breed, colour, age, sex and condition of the animal. Mention its temperament, for it is often important to know whether an animal is normally sluggish, sulky, active, nervous, excitable or vicious. If a horse, say whether or not it is broken in and state the purpose for which it is used. If a female animal indicate whether it is pregnant, and if so, for how long it has been in that state. In writing about a cow always say when she last calved and how much milk she is giving. With sheep, say when last shorn and indicate the length and type of wool carried. With horses some indication of the conformation is often of great assistance.

Having carefully described the animal go on to an equally careful description of its symptoms, which are simply abnormalities arising from its diseased condition. Note first of all any wound or swelling or abscess, and if present describe

these carefully. A simple sketch is often valuable. Do not be afraid to attempt this because you are not an artist. The crudest sketch often tells more than several pages of description. In describing swellings, besides indicating their position and shape, always very carefully state whether they are hot, painful, soft, hard or bony, attached to or moveable under the skin, and whether an impression made by pressing firmly with the finger remains after the finger is removed. With wounds always give their size, shape, depth, and the angle to the ground of long cuts. State if there is a flap of skin hanging, and if any bone or other tissues have been exposed. Indicate the nature of any discharges present, giving colour, consistence and odour. If the discharge seems to be coming from a pocket below the wound, indicate the position and size of this. Always say if a wound is near a joint, and if so whether discharge increases when the animal puts weight on the leg in walking. Describe carefully any abnormality in the position of the animal or any of its organs. State whether its head hangs or is held out straight or to one side. Say whether the ears droop, the eyes protude or are sunken, and whether the third eyelid tends to come further over the eye than normally; whether the lower lip hangs, or the tongue protudes, or the nostrils are dilated; and mention any discharge from the eyes, nose or mouth and describe such carefully. Describe any abnormality in the way an animal stands. For example, it may put one front leg forward or it may rest it with a bent knee; it may continually rest one hind leg; it may stand with both legs forward and hind legs well under; or it may stand very stiffly on all four legs. Mention it if the back is bent either upwards or downwards, or if the tail is carried in an unusual position. Note whether the abdomen is unusually distended and whether this is even or one-sided. If the animal lies down say in what postion it lies, and whether it lies still or rolls or gets up and down frequently, and always mention it if the animal never lies down. Give any abnormality which you may note in its way of moving. For example, state if it goes slugggishly or walks or trots or gallops in an excited way. Describe any lameness very carefully. Give any indications of pain which may be noticed; for example, groaning or looking at or biting any particular part. Mention any abnormality in the action of the bowels.

Three other things are of great importance. They are temperature, heart beat and breathing. Every farmer should possess a clinical thermometer. The standard human half-minute type is the best to buy as it is both more reliable and cheaper than most of the so-called veterinary thermometers. Do not say an animal is feverish, give its temperature, and this should be taken night and morning and any variations carefully noted. Heart beat can be easily counted by pulling the left leg forward and feeling for the beat with the hand on the left side of the chest. Give the number of beats per minute, and say whether they seem stronger or weaker than normal. Note also if they are regular. The breathing can be watched best from the side. Count the number of times the animal breathes per minute. Note whether the ribs are moved or not and whether there is any heaving of the flanks. State if the breathing is regular. Mention any coughing, and say whether this is harsh or soft, and how frequently it occurs.

Having carefully described the present state of the animal, go on to give a careful history of the complaint. Start off by describing the surroundings of the animal prior to its becoming affected. For example, mention the weather, food, the work that was being done, and particularly mention any changes which occurred in any of these. Then give the date and time of day when first symptoms were noted, and proceed to give the course taken by the disease up to the time of writing.

Give full particulars of any treatment applied, stating doses and times, and any effects which you believe to have resulted.

Should the animal die, a post mortem examination should, if possible, be made. Always prepare an antiseptic solution such as Lysol, 2 tablespoonsful to 1 gallon of water. Wash the hands and arms in this prior to opening the animal and repeat after completing the examination. If you cut yourself dry the part and paint the cut immediately with tincture of iodine. These precautions should always be followed, but especially so if the animal has been dead for any length of time. Anyone with a wound on the hand should not conduct a post mortem on such an animal. Post mortem examinations, to be of real value, should always be made as soon as possible after the death of the animal, as degenerative changes take place very rapidly in the dead carcase. In reporting post mortem examinations always state how long the animal had been dead. Horses and cattle can be most conveniently examined by opening them from one side. After skinning, remove the front and hind legs from the upper side. Note any bruises or other injuries under the skin. Next remove the ribs from that side. This may be done by cutting them away from the breast bone and the back bone with an axe or saw, or they may be removed by cutting between them with a knife and severing the joint between the rib and the breast bone and then bending back singly. The abomen is opened by cutting down the centre line and around to the upper flank and pulling back the flap. Smaller animals such as sheep and pigs should be placed on their backs and opened down the centre line. The breast bone may be removed by cutting along the line of joints by which it is joined to the ribs. Remove the heart and lungs and examine them carefully. Note if any parts of the lungs are darker coloured than normal, or have become solid instead of spongy. See if they sink in water. Note carefully any fluid in the chest cavity, and any attachments between the lungs and the ribs, also any fluid or other material around the heart. Next remove the stomach and intestines, and in doing this be careful not to injure these with the knife. Now separate the intestines from their attachments so that they lie in one long tube. The small intestines are those which extend from the stomach to the blind gut or caecum, which can easily be recognised in all animals from the fact that it is closed at one end. The large intestines extend from the blind gut to the rectum. The parts of the stomach and intestines in which disease most commonly occurs are the stomach, particularly the fourth stomach in cattle and sheep, the small intestines, the blind gut and the rectum. The large intestine is often the seat of trouble in horses but less often in cattle and sheep. Open any part which seems inflamed and note its appearance carefully. Note any fluid in the abdominal cavity and any attachments between organs and body walls.

Next examine the liver, kidneys and spleen. Note carefully any abnormalities in size, colour and consistence. Open the bladder and note colour of urine present, also any deposit.

Report anything found which seems abnormal and collect samples of the abnormal parts. Generally these do not need to be very large but they should be cut so as to include both healthy and diseased tissue unless the whole organ is diseased. Sections of liver, kidney, spleen, heart and lungs should in general be about one inch square by one-quarter inch thick. Place the sections in a solution made by mixing one part of formalin with nine parts of water, cork them tightly in a bottle of convenient size, pack carefully and forward with your letter. If worms are present the part of the bowel containing them may be placed in the above solution, or the worms themselves may be placed in a solution made by dissolving one heaped teaspoonful of salt in one pint of water. Always mention whether or not the worms are numerous.

So much for single animals. Where a number of animals are affected, certain particulars should be given in addition to the above. Mention the date the first

animal became affected and, if possible, the dates on which subsequent animals were discovered ailing. Give the total number affected, the number of deaths and the number of animals in the flock or herd concerned. Always mention if any animals had been introduced prior to the outbreak, and if so how long before the first case occurred.

To sum up briefly:

1. Describe the animal.
2. Describe all abnormalities noted.
3. Describe the course of the disease.
4. Detail any treatment which has been given.
5. If the animal dies describe what is seen in a post mortem examination and send samples of abnormal organs.
6. In an outbreak of disease, pay particular attention to numbers and dates.

And that, as briefly as can be given it is the answer to the question, "Just what do these vets. want when they ask for details in connection with sick animals."

Published by courtesy of the Australian Broadcasting Commission, being an educational talk given through Station 6WF on 28th September, 1934.

ERRATA

"Journal of Agriculture," No. 1, Volume 11, March, 1934:

"The F. A. Q. Criticised, with a Suggested Alternative," page 9: In the statement showing Home Consumption in Australia "Sea Carriage 24,108 tons at 30/- per ton . . . . . £36,162" was inadvertently included. The correct statement should read:—

Home Consumption—30 million bushels.		
3% of this = 900,000 bushels = 24,108 tons—	£	£
Sacks—10 million at 9/- per dozen	11,250	
Cartage—24,108 tons at 5/- per ton	6,027	
Railway Freight—24,108 tons at 12/- per ton	14,465	
		31,742
Total		£371,261

Total—	£
Export	339,519
Home Consumption	31,742
	£371,261

"Journal of Agriculture," No. 3, Volume 11, September, 1934:

"Herd Testing," page 396, Table—"Mature Cows":—

Ownership of the cows "Pansy 5th of the Hill" and "Gold of Eastview" should read "D. Bevan & Sons, Serpentine," and not "W. G. Burges."

The cow "Koojan Dulcie," H. B. No 1255, owned by Mr. A. W. Padbury, was omitted, her production being 8,994lbs. milk, 5·88% average test, and 529·62lbs. butter fat in 273 days. This record places her second on the list, and Mr. W. G. Burges' cow, "Kurrawong Kitty 8th," will move to third place.

"Factors Influencing the Production of Clean Milk," page 419, paragraph 3, line 2: "....temperature of 100° Fah." should read "....temperature of 160° Fah".

Page 422, Table at end of page:
"April 2nd . . . 1,000,000" should read "April 2nd . . . 100,000."

AN ENTOMOLOGICAL APPEAL.

As the Green Tomato Bug (*Nezara viridula*) is again showing up in numbers in various districts, the Entomologist would remind growers that the Green Bug egg parasite *Microphanurus megacephalus* has been successfully carried over the winter both in the field and in the laboratory.

Some 30,000 of these tiny wasps were distributed last summer. It is desired to continue this work of breeding and distribution of this beneficial insect, but to

do so it is necessary to secure eggs of the bug. The Entomologist therefore appeals to growers to collect and forward as many rafts of these eggs as possible to the Department of Agriculture, Perth.

The eggs, to be of use, must be of a creamy yellow colour. If they have turned pink they are too far advanced and should be destroyed. If rafts of eggs are found to be turning dark they should be left alone, as the darkening is due to the presence of the developing parasite within the egg.

In return for eggs forwarded, colonies of the parasite will be supplied.

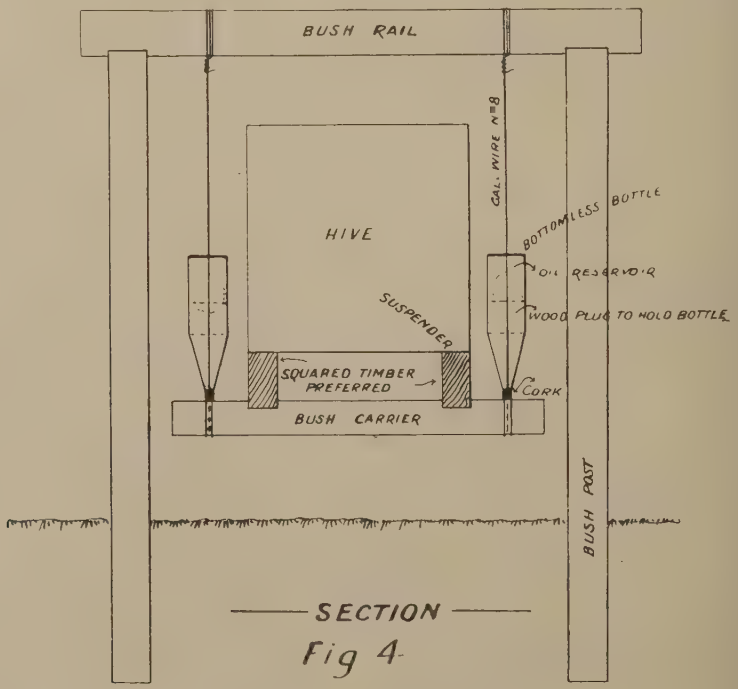
LOCATION AND MANIPULATION OF APIARIES.

(Continued.)

H. Willoughby Lance, Apiculturist.

6. Addendum.

A cheap stand may be made with bush posts and old bottles as shown in figs. 4 and 5. The bottles have their bottoms broken off by soaking a piece of string in kerosene and tying round the bottle, lighting the string, then when the bottle is hot dipping it in cold water up to the string. The wire may be threaded through a hole in the cork, or a slot cut in the side. A convenient height for the hives is 12 inches from the ground. About two inches of sand should be placed in the bottom of the bottle.



SECTION

Fig 4.

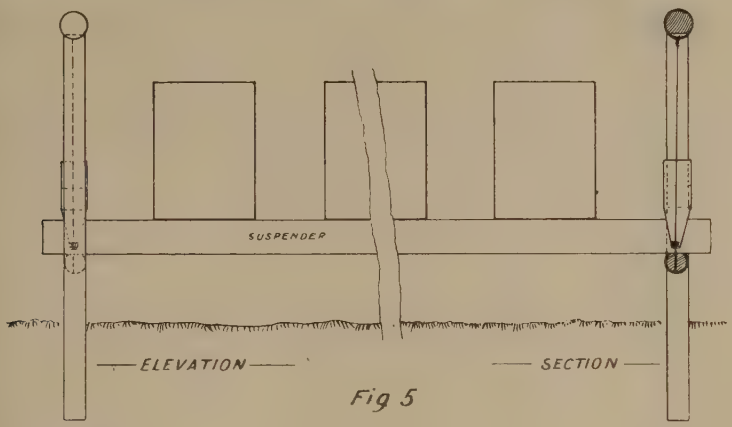
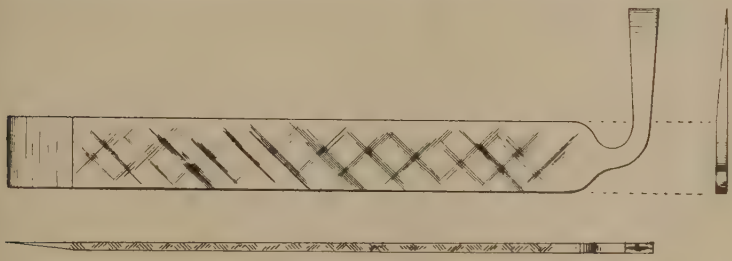


Fig 5

14. Addendum.

Fig. 6 is an illustration of the hive tool referred to in this paragraph.



HIVE TOOL
Fig 6

15. Swarming.

In past days beekeepers anxiously looked for swarms and considered these as part of the success of beekeeping, and would probably boast of the number of swarms from their bees. Those days are past. Beekeepers now count their success by the small number of swarms that issue, and the large size of their hives, their motto being few but crowded hives. One hive of 30 to 40 thousand bees will produce more honey than 3 of 15,000 each.

The problem now is to prevent swarming. This, of course, cannot be done entirely, but by having bees from non-swarming strain, and by study and careful manipulation, swarming can be reduced to a minimum and the honey harvest increased.

Young queens seldom swarm unless the hive is very much overcrowded. Requeening at the end of the season means a young and vigorous queen for the spring. Given plenty of room for brood rearing and honey storage and the right climatic conditions, a young queen is not nearly so likely to swarm as an old one.

Normally, a colony will only throw out one swarm. Some will, however, send out several, and these queens should not be kept or bred from, but young queens

from colonies not inclined to swarm should be introduced. If the beekeeper does not understand queen rearing, he should purchase queens from a reliable breeder or a book on Queen Rearing.

The Causes of Swarming are several. As referred to above the bees may be from a swarming strain, and will swarm at every opportunity without due cause. Re-queening is the only cure for this.

Another cause is that the queen has bred well and filled the brood combs with bees, and they in turn have filled the hive with honey so that there are few empty cells for the queen to lay in, or the bees to store honey. This may be prevented by giving plenty of room in advance, by adding a second, third, or fourth storey as may be required. When this is done one or two frames of brood and one or two of honey should be taken from the lower chamber and placed in the centre of the added one, this will draw the bees into the new chamber; the rest of the chamber being filled with frames fitted with *full sheets* of *foundation*. The brood in the lower chamber should be closed up to the centre of the hive, one of the new frames with full sheets of foundation next, then the combs of honey and pollen, and if there is still room for new combs, these may be placed on the outside. If drawn combs are available it is preferable that these should be placed between the brood and the honey. Brood combs in the lower chamber should be directly below the brood combs in the upper one and any bar of honey above the brood in the lower chamber should have the cappings bruised to induce the bees to remove the honey and the queen to use the two chambers. Good queens in a good season will breed in both the first and second stories, the third and fourth stories being used for surplus honey.

Another cause of swarming is changeable weather during the spring breeding season. A few fine days with plenty of honey and pollen coming in induces the queen to lay rapidly. Then a few wet and cold days follow and the bees are confined to the hive. More good weather and rapid breeding, then cold and wet, until there comes a spell of bad weather, the hive being full of young bees and the old field bees being unable to go out, there is an overcrowded feeling and they prepare to swarm. Cutting out queen cells may prevent this for a time, but if changeable weather continues and there is a poor honey flow, the bees may make several attempts and at last get away.

Given good weather, a good honey flow, and good bees, swarming can usually be prevented by proper manipulation.

It has been stated that bees have a "one track mind." Under certain conditions the swarming reflex dominates all others. Then again, on account of the irregular and periodic nature of the honey flows, bees have learned to put honey gathering in the forefront of their activities; therefore, when there is a good honey flow on and they have sufficient storage room, the honey gathering reflex dominates.

16. Increase.

It may be asked how to prevent swarming and at the same time increase the number of colonies. This may be done by what is known as artificial swarming.

A normal colony contains bees of all ages. The "baby" bees clean out and polish the cells for the reception of eggs, when a few days old they feed the older larvae with honey and pollen. Later when their brood food glands develop they make the "cheyle food" or bee milk and the royal jelly for the very young larvae. Next they are engaged on general home duties, cleaning the hive, guarding the entrance, storing and capping the honey and pollen. During this later

period they take a number of "play flights" so that they may learn to locate their home and be able to return to it. Lastly, they become "field bees," and roam abroad in search of nectar and pollen.

A natural swarm consists of bees able to perform all duties except those of the very youngest. Therefore, in making an artificial swarm, we must endeavour to make it as near as possible to that of a natural one.

If a colony is a two-storey one, strong in bees of all ages, with plenty of honey and pollen, it may be divided as follows:—

Prepare a new floor board, body box and cover. Move the original hive on one side and place the new one on the original stand. Look through the old hive until the queen is found, then place the frame with the queen in a safe place, so that she will not get back into the hive. Take out three or four combs containing unsealed brood with adhering bees and place in the centre of the new hive, with an empty or partly empty comb on each side, fill up the remaining spaces with combs of honey and pollen. This hive will now be in the same condition as if it had swarmed, except that there will be no queen cells. It is advisable to give it a ripe queen cell or a young queen, or if these are not available, it may be allowed to breed up one of its own. This, however, will mean a delay of three or four weeks before any further eggs are laid, and 6 weeks before the young bees emerge.

This original hive should contain one or two frames of capped brood with as little uncapped brood as possible, some combs of foundation or empty combs and two or three of honey and pollen, the frame with the queen being placed in the centre. The entrance should now be closed with fly wire and the hive stood in a shady place. On the evening of the day following it may be placed on its permanent stand; the fly wire removed and the entrance lightly stuffed up with fine grass so that the bees cannot get out next morning without pulling it away. This will cause them to take new bearings, and only those that come out late in the day after the grass has been removed may find their way to the old stand. This hive will now contain bees of all ages, the original queen, and a little emerging brood, and given a honey flow will rapidly build up to a strong colony.

The following plan for making three colonies out of two is from "The Bee World" by L. Illingworth, and should be an excellent one and secure a larger crop of honey as well as increase of colonies than with the dividing method.

"When the weather is warm and colonies strong, but if possible, just before preparations are made for natural swarming, take two good colonies, A and B, place the comb with queen and adhering bees from A in the empty hive, fill up with frames of foundation or empty combs, and set it on stand A in place of the original colony. Put roof on the new hive now on stand A. Now open the old colony A which has been moved aside, select about half the remaining combs containing unsealed brood, shake and brush the bees off them on to the alighting-board of the new hive, letting them run in to join their queen there. Replace these brood-combs in the old hive where they came from in the same order, inserting an empty comb or frame of foundation to fill up the gap where the comb with the queen was taken. If queen cells are seen the best should be left and that comb set aside and not shaken. All other combs should be examined, whether to be shaken or not, and all other cells destroyed. Close the hive containing the brood and remaining bees and set it on stand B removing hive B to a new position C. Stand A now has all its old flying bees, half its young nurse bees, their own queen and one comb of brood. Stand B has all its old flying bees, all A's brood, and half A's young nurse bees, but it is queenless. If a queen cell has been left or given, then an examination must be made a few days later to make sure it has not been

destroyed. Otherwise a young queen must be introduced or the colony allowed to raise one. Stand C has B's queen and brood and all B's young bees, but no flying bees. The bees on stand C will therefore be able to feed any amount of brood, but will be unable to defend their hive or to forage until they grow older. As the operation will be carried out when the weather is warm and during a honey flow, there will be little danger of robbing, and there should be a good amount of honey in the hive, so with care and attention on the part of the beekeeper no trouble should arise."

A still better plan of making three colonies from two, and which the writer considers simpler, is as follows:—

Proceed as before but use only foundation in the empty hive on stand A except the one comb with brood and queen. This is to prevent the colony swarming later, as it might if drawn-out comb were used. Shake and brush *all* the bees from *all* the remaining combs into the new hive on stand A. This makes a very strong swarm with bees of all ages. Replace all the bare brood and honey combs from which the bees have been shaken in the original body-box if suitable, after shaking off any bees that are still clinging to it, or in a deep super, keeping them in their original order, filling up the space from which the comb with the queen was taken by closing up the brood combs and putting a spare comb or frame of foundation on the outside. Now remove the roof from colony B and set the box of bare brood on top of B over a queen excluder and cover up. If colony B has already got a super on with an excluder, just put the brood on top of the super. Do not move colony B. In the course of an hour or so numbers of young bees will have come up from below to attend to all this extra brood. As soon as the brood is seen to be well covered with bees, remove it bodily and set it up in a new hive in a new position. The entrance should be contracted so that only one or two bees can get in at a time to discourage robbing. Unless plenty of honey was seen in the combs when shaking the bees, a comb full of honey should be given to the C colony, or it may have to be fed. A queen cell or young queen should be given when setting up the new colony C.

MILK AND CREAM STORAGE.

M. Cullity, Senr., Agricultural Adviser, Dairy Branch.

Previous articles in this Journal have emphasised the necessity of care and strict cleanliness in handling dairy produce. The principles underlying the various operations recommended have been explained, and it is felt that good results are accruing.

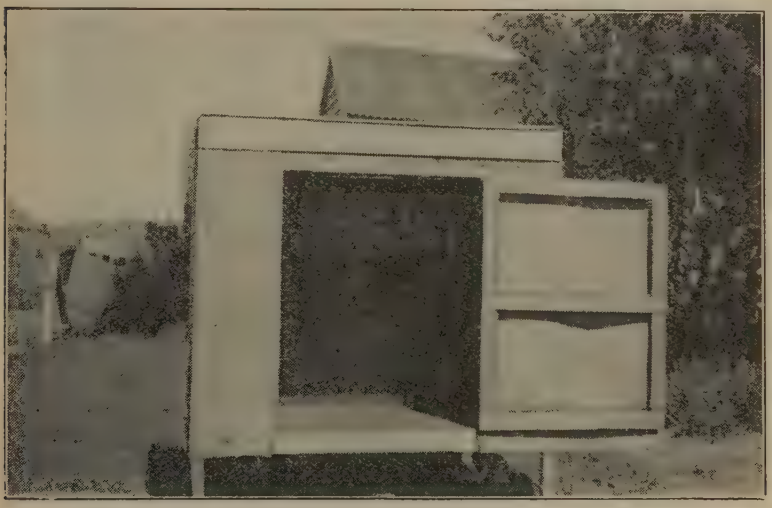
The same principles governing the care of milking yards, sheds, and utensils apply also to separator and cream storage rooms. Inferior cream is frequently traced to faults in these rooms. Unclean floors, contaminated with spilt milk and cream, are developing grounds for bacteria which find their way into the atmosphere and so directly contaminate the fresh milk and cream. Uneven floors, walls and ceilings also provide areas which more readily collect dust of various forms which is dispersed again through the room by air currents.

The disposal of wash water directly outside the store or separator room, or the use of this water for washing down the floors, must also be condemned, because of the presence of milk constituents which would prove helpful to the development of

harmful bacteria on the floors or in the immediate vicinity of the room. For washing floors of dairies or the benches or tables installed therein clean boiling water and soda is recommended. A broom on the floor and a scrubbing brush on the woodwork will facilitate keeping these in good order.

The dairy is provided for the storage of milk and cream only. No other material should be stored within its walls. Milk is a particularly delicate article and is easily damaged by odours or taints absorbed from articles stored in the vicinity. Perhaps the most disagreeable absorbed taint is that from a dirty cow-yard, which is one of the many reasons for keeping the yard clean and for having the dairy some distance away from it. Odours may be absorbed from fruits, meats, and vegetables, which are frequently stored in or near dairies. It is on this account that regulations require that milk or cream should be stored separate from other produce.

In addition, apart from the damage done by air-borne contamination from the floors and walls of a dairy and from absorbed odours, attention must be drawn to the effect of faulty construction, leading mainly to bad ventilation such as occurs in cellars. The result from this condition is a musty flavour and smell in the produce.



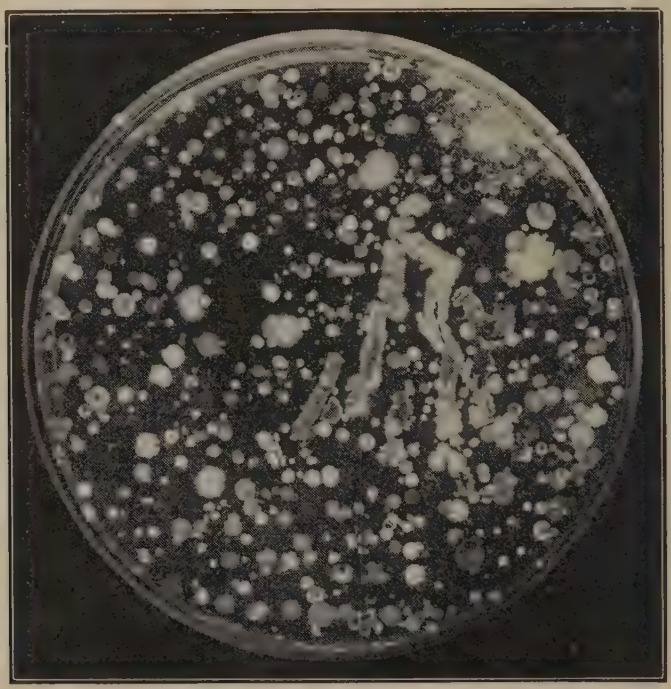
I. Type of Coolgardie safe proved unsuitable for the storage of cream.

The desire to put into effect the recommendations regarding the cooling of milk and cream is responsible for the the use of the Coolgardie safe in this connection. While these are fairly effective in reducing the temperature inside their walls, attention must be drawn to the danger of the use of these safes if the hessian sides are allowed to become dry. A considerable amount of dust is caught on this material during a season and there is a possibility of some splashes of milk reaching it. The result is that when dry the slightest movement of the safe means the unloading into the atmosphere inside of millions of bacteria and spores. These settle on the surface of the milk or cream and are eventually stirred in. A still

more serious position arises where air currents can disturb or flap the sides. This means a continual movement with resultant increase of the bacterial concentration of the air inside the safe. Specific cases have been noticed within the last few months where these safes have been the cause of inferior quality cream being produced.

For purposes of illustration one such case may be cited, which was investigated in conjunction with the management of the South-West Co-op. Dairy Farmers, Ltd., Bunbury.

The cream received from a certain farm was being continually "second graded" on arrival at the factory. A visit was made in order to assist in locating the trouble. Various faults were seen which would result in inferior quality, such as, failure to scald the milking machine, and the hot water supply being at some dis-



II.—Plate exposed for two minutes in safe shown in Illustration I. The large growths are moulds. The smaller being bacterial colonies.

tance from the sheds. These and other faults were remedied but trouble was still experienced with the cream, which had a peculiarly unpleasant flavour. The management of the factory then demonstrated that the methods advised and being used were successful inasmuch as the cream coming from the separator was sound, but after the storage on the farm the peculiar flavour referred to became evident. The points between the separator were then checked and the safe used for storage purposes tested by exposing a plate containing a culture on which the bacteria could

fall, and after growth be conveniently counted. This plate was exposed for two minutes, the walls being moved gently as if by the wind, as the safe was in an exposed position where any breeze could reach it. The result allowed no doubt that the safe was the cause of the flavour, as the organism predominating in the cream was identical with that obtained from the safe. The exposed plate is shown in Illustration 2, after the organisms had developed into colonies. Each spot in the latter represents where at least one micro-organism fell and developed into numbers sufficiently large to be seen by the naked eye.

This safe was in a position where prevailing winds could reach it, thus helping to cool the cream within it by assisting evaporation of water from the hessian sides in the summer months, but with undesirable results whenever the hessian was allowed to dry.

It is recommended that all due precautions be taken in the use of these safes to prevent a possibility of the sides becoming dry. A good idea is to line the safe with perforated zinc and to have the hessian covering on the outside. It can then be used as a cooler in the summer and as a fly-proof safe in the winter months by simply removing the hessian.

Dairies lined with hessian or similar material, whether whitewashed or not are also likely to cause trouble.

Where dairies are covered by creepers or shade trees to lower the temperature during the summer months, it is recommended that accumulation of dead leaves or superfluous growth should be prevented by periodical pruning or clipping, as such dead matter would be a means of providing dust in windy weather which might contaminate the dairy produce stored in the dairy.

FRUIT EXPORT SEASON, 1934-35.

Geo. W. Wickens, Superintendent of Horticulture.

A vital change in the regulations governing the export of apples from Australia will take place next season, with the introduction of colour grading, and until packers become used to selecting fruit of sufficient colour for either of the only two grades permitted shipment (Extra Fancy and Fancy), the number of cases packed per day will be considerably less than under the previous regulations, when size and blemish were the principal factors. Though packing will, necessarily, be slower, I am certain the alteration will prove beneficial, and will result in more uniform and better quality fruit being shipped.

In normal seasons in Western Australia apples colour well, but a bad fault in the past has been a mixing together in the same case of highly coloured, moderately coloured and non-coloured fruits. This undesirable mixture will not receive, under the new regulations, a permit to export, even though every apple in the case complies with regulations in other respects. The colour requirements will be divided into: "Solid Red," "Partial Red," "Striped" and "Yellow or Green," and every variety of apple permitted to be exported will be named in the regulations and placed under one of the above headings.

"Solid Red" apples, such as "Democrat" to be of "Extra Fancy" grade, must have 70 per cent. of the surface of every apple covered with red, and for "Fancy" grade must have 35 per cent.

"Partial Red" apples such as 'Jonathan," "Delicious" and "Rokewood" must in "Extra Fancy" have 50 per cent. of red colour, and in "Fancy" 20 per cent.

"Striped" varieties such as "Nickajack" and "Statesman" must have 30 per cent. red colour in "Extra Fancy" and 10 per cent. in "Fancy."

"Yellow and Green" apples must not be mixed together in the same case, but either yellow or green apples of the same variety may be labelled "Extra Fancy" if they are packed separately, and are of "Extra Fancy" quality.

The only change in the grade standards for pears will occur in the naming, "Extra Fancy" taking the place of "Special"; "Fancy" taking the place of "Standard," and "Good" taking the place of "Plain."

Particulars given hereunder of grade standards, including colour requirements and sizes, are as recommended to the Department of Commerce by the Apple and Pear Council, and it can be taken for granted that the regulations when printed will closely approximate these. I, therefore, most earnestly commend them to growers and packers for serious consideration so that the disappointments and heart-burnings caused by rejections at the ports may be kept down to a minimum.

GRADES FOR APPLES.

Blemish Tolerance.

Extra Fancy Apples shall consist of sound, clean, well-formed mature apples of one size and one variety, free from broken skins and from disease. Slight blemishes from any cause may be permitted, provided such blemishes do not exceed 10 per cent. by number of the total fruit in any case, and provided that the total area covered by such blemishes on any apple does not exceed the area contained in a circle having a diameter of one quarter of an inch.

Russeting shall not be considered a blemish, provided that not more than 10 per cent. of the surface of each apple is affected. No apple in this grade shall be less than 2¼ inches in diameter.

Fancy Apples shall consist of sound, clean and fairly well-formed mature apples, of one size and one variety, free from broken skins and from disease.

Slight blemishes from any cause may be permitted, provided such blemishes do not exceed 10 per cent. by number of the total fruit in any case, and provided that the total area covered by such blemishes on any apple does not exceed the area contained in a circle having a diameter of one-quarter of an inch.

Russeting shall not be considered a blemish, provided that not more than 30 per cent. of the surface of each apple is affected: provided this does not apply to the Sturmer variety each apple of which may be 50 per cent. russeted. No apples shall be less than 2¼ inches in diameter, except in the case of specified varieties.

VARIETIES OF APPLES—COLOUR REQUIREMENTS.

Solid Red—70% *Extra Fancy*, 35% *Fancy*.

Democrat	Duke of Clarence	King David

Partial Red—50% *Extra Fancy*, 20% *Fancy*.

Crofton	Yates	Scarlet
Geeveston Fanny	Aromatic	Rokewood
Jonathan	Delicious	Australian Beauty
Worcester Pearmain	Dougherty	Schroeder
Tasman's Pride		

Striped Varieties—30% *Extra Fancy*. 10% *Fancy*.

Alexander	Pomme de Neige	Crow Egg
Cox's Orange Pippin	Ribston Pippin	Nickajack
King Pippin	Statesman	Prince Alfred
Rome Beauty		

Yellow or Green—Uniform Colour.

Cleopatra	French Crab	Stewarts
Newtown Pippin	London Pippin	Alfriston
Sturmer	Mobbs Codlin	Dunns
Stone Pippin	Reinette du Canada	Granny Smith

Class.	Variety.	Size.
Dessert	Cox's Orange Pippin	2in. to 2⅝in.
,,	Crofton	2⅛in. to 2¼in.
,,	Jonathan	,,
,,	King David	,,
,,	King Pippin	,,
,,	Pomme de Neige	,,
,,	Yates	,,
,,	Worcester Pearmain	,,
,,	Scarlet	,,
,,	Aromatic	2¼in to 2⅜in.
,,	Cleopatra	,,
,,	Delicious	,,
,,	Dougherty	,,
,,	Geeveston Fanny	,,
,,	Newtown Pippin	,,
,,	Ribston Pippin	,,
,,	Rokewood	,,
,,	Sturmer	,,
,,	Statesman	,,
,,	Australian Beauty	,,
Culinary	French Crab	2⅝in. to 3in.
,,	London Pippin	2½in. to 3in.
,,	Mobbs Codlin	,,
,,	Reinette du Canada	,,
,,	Stewarts	,,
,,	Schroeder	,,
,,	Alfriston	2½in. to 3¼in.
,,	Prince Alfred	,,
Dual Purpose	Alexander	2¼in. to 3in.
,,	Crow Egg	,,
,,	Duke of Clarence	,,
,,	Dunn's	,,
,,	Granny Smith	,,
,,	Rome Beauty	,,
,,	Nickajack	,,
,,	Tasman's Pride	,,
,,	Stone Pippin	,,
,,	Democrat	2¼in. to 3¼in.

In the sizes given above it will be noted that "eighths" are for the first time to be mentioned in regulations, and that Cox's Orange Pippin is the only 2-inch variety to receive an export permit.

In conclusion, I would point out that at time of writing (November) the outlook for an abundant crop of prime apples was never better, and the task of living up to, and packing up to, the new grades will be much easier than in a year of light crops with over-sized fruits and drab colours. Christmas will be with us when this Journal reaches growers, so I shall take the opportunity of wishing all a festive time in the holidays and an export season in the New Year free from permit refusals and inquiries under Part XV. of the "Commerce Act."

SUMMER FODDERS.

C. Giles, Dairy Instructor.

Preparing the Seed Bed.

Many acres of land are now being ploughed for the seeding of maize, Sudan grass, Japanese millet, etc., and whether these crops are to be grown on irrigated or non-irrigable country, the thorough preparation of the seed bed is of primary importance.

Fallowing.

This practice, although desirable, is not at present generally adopted, and many acres of maize, etc., may be seen each year returning yields which are both disappointing and unprofitable.

There are two chief causes of failure:—

1. The selection of unsuitable land; and
2. Insufficient preparation of the seed bed prior to seeding.

These crops grown for summer use require warm, congenial conditions, and cannot be expected to thrive unless these requirements are present. Therefore, well-drained country is desirable and the practice of fallowing should be adopted in order to conserve sufficient moisture to carry the crop to maturity, and the practice would also assist in providing the firm seed bed which is so desirable.

Under a system which provides for the working of fallowed land, the use of a roller to break clods or compact the soil is unnecessary.

During the period of fallow, any clods that may have been present originally after ploughing will have been weathered down into good tilth, and the soil is more thoroughly compacted by the forces of Nature than could possibly be done by any farming implements. The practice usually adopted of ploughing the land almost immediately prior to seeding and of harrowing once or twice before sowing, does not permit of a firm seed bed being prepared.

Need for Care.

In following the above practice, every care should be taken to thoroughly consolidate the soil prior to seeding. The plough by cutting off a layer of surface soil, and returning it loosely and partially inverted, breaks the connection between the undisturbed lower soil and the surface, and consequently forms a most effective mulch. This is especially the case if a sod or the residue of a green crop has been turned under.

It will be seen, therefore, that unless thorough working takes place, in order to re-establish the connection between the surface soil and that beneath, the flow of water upward by capillarity will probably be insufficient to bring about satisfactory germination, especially when seed is drilled and placed in the loose ploughed layer.

Should rain fall sufficient only to secure germination, there is every possibility that, should dry conditions follow, the grain will be "wilted" sufficiently to cause partial if not total failure.

The use of the disc cultivator on clay land prior to ploughing has been found effective in preventing the formation of large clods, which are difficult to work down to the fine tilth necessary to ensure an adequate supply of moisture for the seed to germinate.

THE DIPPING OF FLOCKS AS A ROUTINE PRACTICE IN SHEEP RAISING.

H. McCallum, Sheep and Wool Inspector.
W. McC. Johnson, Cadet.

Although this Department, year by year, makes an appeal to sheep farmers in the South-West Division of the State to regard the dipping of their flocks as part of the annual routine of sheep raising, just as is the culling or the shearing, the number of flocks infested with lice and tick does not decrease. As it has been frequently shown that one dipping in a suitable dip will maintain a flock free from lice and tick, it appears that either this operation is not being performed with sufficient care to ensure its effectiveness or it is not being sufficiently widely carried out to prevent the dangers of reinfestation from outside sources.

Perhaps the most common cause of failure of the dip to free the flock from lice and tick is that the instructions for mixing issued by the manufacturers are not strictly adhered to. In order to prepare the dip at the suggested strength it is desirable firstly to measure the capacity of the bath. One method of doing this is to run in water from a tank of known capacity and to make a mark on a measuring rod indicating the level of the water after successive quantities of, say, 100 gallons have been added. Once the capacity of the bath is known the dip may be added in the proportions suggested. The dip should be thoroughly cleaned out before preparing the bath. If only hard or saline water is available it may be softened by adding 3 lbs. of washing soda to every 100 gallons.

The dips commonly used may be divided into (a) the poison dips and (b) the contact dips, which are frequently erroneously called non-poisonous. In the first group the essential constituent is generally arsenic in some form, while the second group contain cresylic acid and other coal-tar derivatives. Generally speaking, either group of dips will give satisfactory results, but this Department recommends the powder dips, because, owing to their sulphur content, they are generally more lasting, while the carbolic dips if manufactured from impure tar products may injure the wool.

A second cause of failure in dipping is that the sheep are in the dip for too short a time. It is necessary that the animals should be immersed for at least one minute. Their progress through the dip may be checked if necessary. It is also necessary to duck each sheep at least once so that the dip will reach all parts of the skin.

In regard to reinfestation from outside sources the chief danger lies in contact with undipped sheep. In order to minimise these dangers a clean muster must be obtained and all sheep, including ration sheep, should be dipped. Secondly it is advisable to regularly inspect all boundary fences to make sure they are secure.

Another possible cause of reinfestation is the placing of sheep in sheds or yards where infested sheep have recently been. It is probable that this is seldom a source of danger, as various experimenters claim to have shown that three weeks is the maximum period which these parasites can live away from the animal body.

The most suitable time to dip a flock is from four to six weeks after shearing. They should not be dipped when they are hungry or thirsty, nor on the other hand when they are gorged with food. They should be dipped in dry settled weather, and work should be stopped early so that they may dry before nightfall. If the sheep are hot with travelling they should be allowed to cool down before dipping is commenced.

In 1895 legislation was enacted to enforce the annual dipping of all sheep in the South-West Division of the State with a view to eliminating the serious annual loss resulting from the ravages of lice and tick. It is believed that the value of the wool from an infested flock may frequently be reduced by as much as 6d. per lb. This reduction in value is due to the fact that infested animals scratch and bite at their wool and rub against convenient objects such as fences and logs in an effort to allay the irritation caused by the parasites.

The legislation to which reference has been made is contained in a section of the Stock Diseases Act, which provides that—

(1) all sheep in the South-West Division of the State shall be dipped on or before the first day of February of each year;

(2) the owner or occupier of the land on which the sheep are depasturing shall be responsible for the dipping;

(3) no sheep infested with tick or lice shall be offered for sale either privately or by auction or removed from the property on which they are being depastured until they have been dipped.

The Act also provides that within fourteen days of the dipping of his sheep the owner shall make a statutory declaration before a Justice of the Peace stating that he has dipped his sheep in accordance with the provisions of these regulations, advising of the date of dipping, the number of sheep dipped, and the class of dip used, and that he shall forward this declaration to the Chief Inspector of Stock.

It is intended in the future to administer this Act more rigorously in an effort to combat the growing menace of lice and tick infestation.

CAULIFLOWER PRODUCTION.

W. E. Collins,
Potato Branch, Department of Agriculture.

Cauliflower is not one of the easiest crops to produce. It requires close personal supervision and congenial climatic and soil conditions. Since the industry is a highly specialised one, the individual who grows cauliflowers consistently year after year will find it more profitable, as a rule, than one who produces them intermittently.

Cauliflower develops best in those areas where the temperature during the latter part of the growing period is cool and uniform, and where fairly moist conditions prevail. Extremely low temperatures while the plant is young may cause it to "button" or head prematurely. Low temperatures delay maturity, reduce the size, and consequently lower the acre yield.

Hot weather during transplanting time may interfere with the rapid establishment of the plants in the field. If it occurs while the head is maturing it often causes yellowing and gives it that "fuzzy" appearance so often met with. High temperatures appear also to stimulate the growth of the head leaves and in many cases, causes them to appear through the top of the flower. The head itself often grows so rapidly under these conditions that harvesting at the best stage of development is almost impossible, especially when large numbers are being handled. Areas subject to cool climatic conditions usually suffer smaller losses from overmaturity.

Cauliflower should always have a sufficient supply of moisture in the soil to insure a continuous and steady growth. It does not thrive in dry sections, especially if they are subject to extremes of temperature or to dry wind storms. This crop makes its best development in a moist atmosphere. Well distributed rainfall or carefully regulated irrigations are necessary for the successful production of this crop. These conditions help to produce maximum yields, large sizes, and good quality.

Cauliflower can be grown profitably on a variety of soil types. Generally speaking, however, the soil selected should be fertile, of good physical condition, retentive of moisture, and well drained. Where a number of different soil types are available, the medium and heavy soils should be used for varieties suitable for late plantings, as they are cool and retain moisture well. When it is to mature during the rainy season, the crop should be planted in sandy or silty soils. These are usually so well drained that cultivation and harvesting can be done without puddling the land. Though such soils produce good crops during the rainy season, they make low yields when used for very early or very late plantings. Soils of very light texture should be used for cauliflower production only when they are abundantly supplied with organic matter, which increases the water-holding capacity and cuts down labour by decreasing the number of irrigations needed.

In most of the cauliflower-growing districts around the metropolitan area, the plants are started in the open. The two types of seed beds generally used are the sunken panel bed, and the raised seed bed. Where the soil is light and porous and not subject to packing, sunken seeds beds are preferable. A given area of land in sunken panels will probably accommodate more plants than the same area in raised seed beds. Moreover, sunken beds have a minimum of surface exposed, and hence dry out more slowly than raised beds. On the heavier types of soil that form a thick crust after watering, raised beds have usually been found more satisfactory, as they facilitate quick growth.

Seed should be sown in drills, 12 inches apart and sufficiently deep to be in contact with moist soil, but not deep enough to prevent the germinating seedlings from reaching the surface. One-half to three-fourths of an inch in depth is usually sufficient. In hot dry weather, the depth should be greater than in cool moist weather. Sow for early crops during December, and continue sowing for later crops until June. A chart of the varieties and the dates of planting in the seed beds will help the grower to avoid confusion and mistakes at times of transplanting, when more than one variety is sown. Care should be exercised to develop healthy stocky plants. If the seedlings are too thick in the bed, they should be thinned to prevent overcrowding. Under the best soil and climatic conditions, and with a well-prepared seed bed, it may be possible to produce good plants without the addition of water after the seed has been sown. The best growers water only when absolutely necessary. A watering shortly before pulling the plants produces succulent roots, many of which die during transplanting. The shock of transplanting is less severe if the plants have been deprived of water somewhat and have been allowed to harden, than if they are in a tender, rapidly-growing condition. If the soil is hard and the plants cannot be pulled readily, the beds should be watered the day preceding pulling. It is best not to wet more of the plant bed than will be used the following day. However, if the soil is loose this watering is unnecessary. Plants are usually of sufficient size for transplanting six to nine weeks after seeding, depending upon the time of the year. A surplus of plants should be grown, so that only the best and strongest need be used for transplanting. Only the largest are removed at first. A watering should be given immediately after the first pulling to stimulate the growth of the remaining plants.

An effort should be made to secure a uniform continuous growth. If plants remain in the seed bed for too long a time, growth is severely checked and premature heading is often brought about. Soil which does not hold water well should be watered frequently enough to promote an even and normal growth. Water should be withheld about a week or ten days before pulling. Usually only two pullings should be made from a bed. If the leaves are very large, they may be trimmed to reduce the loss of water. Plants which are well hardened need very little, if any, cutting back of the leaves.

After the plants are pulled, every effort should be made to get them into the ground quickly, and whatever replanting is necessary, should be done as soon as possible. Crowding should be avoided, as it reduces the size of the head. Rows should be 34 to 36 inches apart, and plants about 24 to 30 inches apart in the row, depending upon the variety.

It is very essential that the different varieties and strains be planted at the proper time. Experienced growers claim that each variety has a definite limit in planting dates, beyond which favourable results cannot be secured, and that only varieties which have been developed for a particular season of the year should be used.

Some growers make plantings every ten days or so, beginning with "first earlies" then continuing with "second earlies," and so on to the later varieties. Others specialise in a general or main crop such as the "Mid-Summer Beauty" or the later "Veitch's Autumn Giant." Another variety "All the Year Round" has found favour with not a few as a single variety cropper. However, though different growers vary their planting procedure somewhat to suit their local conditions, their main object is to have a continuous harvest throughout the season.

The aim of the grower should be to produce heads of a medium large size, for which there is usually a good demand, therefore the soil must be made sufficiently fertile to produce this quality. A large head cannot be obtained from a small plant. The plant food elements should be present in available form and in sufficient amount to give a continuous growth. While phosphorus, potash, and other plant food elements are necessary, the one most generally needed is nitrogen. There is considerable difference of opinion among growers as to the value of the various fertilisers. Many of the more successful growers have large supplies of stock-yard manure available. Cauliflower fits in well with dairying; and an abundant supply of manure may thus be obtained. Where livestock is kept on the same farm, the task of maintaining the soil in a highly productive condition is not a difficult one. Ten to 20 tons of manure may be considered a good annual application. If the farmyard manure cannot be obtained in sufficient amount to supply the needed organic matter, green manure crops alone or with commercial fertiliser may be used. The cover crop or green manure crop, preferably a legume, chosen should be adapted to the local conditions, and should produce a good tonnage of vegetable matter to plough under.

In certain cauliflower sections, the high price of land prohibits the planting of green manure crops, and the productivity of the soil, therefore, must be maintained largely by the use of commercial fertilisers. The three constituents supplied in a complete fertiliser are nitrogen, phosphorus and potash, and these are to be found in well-balanced proportions in the ordinary commercial potato manures. It is impossible to specify a single kind or a uniform rate of application of fertiliser for the entire State, or for any large district within the State. It is best for each grower to make a number of tests of his own land to determine the kind to use and the most profitable amount to supply. In general, growers have found that it is the lack of nitrogen which limits the growth of the cauliflower

plant. Nitrogenous fertilisers, therefore, usually give the greatest growth response, and a mixture much in favour with our most successful growers is composed of potato manure and blood and bone in the proportion of 5 bags of the former to 3 of the latter. An application of about 10 to 12 cwts. of this mixture to the acre should give good results. If the plants are making a slow growth or if they appear yellowish green, a side dressing of 100 to 150 pounds of nitrate of soda or sulphate of ammonia to the acre usually causes a quickening of the growth rate and a darkening of the leaves.

The market demand is for a pure white head. Varieties such as "Early Snowball" have a small amount of foliage, which neither covers the head nor protects it from the weather. To prevent discolouration it is necessary, therefore, to gather together, and tie or pin the outside leaves over the head. Breaking the leaves over the head, a method sometimes used, is unsatisfactory, as the wind is likely to displace them. Moreover, if they decay, a yellowing of the head results. When the head is small, it is well protected by the small inner incurving leaves. As it increases in size, the leaves gradually lift, thus exposing the head. Some varieties of cauliflower such as the "Mid-Summer Beauty," "Dwarf Erfurt," "All the Year Round," etc., are sufficiently protected until the heads are ready for harvest and, therefore, need not be tied. The length of time necessary for the development of the heads to a marketable condition after tying depends chiefly upon the temperature. During warm weather they may be ready for harvest within two or three days, but during the cooler part of the year, as long as two weeks may be required. It is imperative that the heads be cut while they are compact. It is a common error to allow the head to get past its prime before cutting. There is very little danger of cutting the heads before they have made their proper size. If the plants have not made good growth, the heads will not grow large, regardless of the length of time they remain in the field. It is generally considered a better policy to disregard the size feature at the time of harvest and consider only the stage of maturity. Again, the stage of development of the head affects very markedly its carrying qualities. The longer heads are left in the field after they are ready to cut, the more wilted they appear when they reach the market. If the head has begun to separate and spread, it deteriorates much faster than one compact at the time of cutting. Occasionally during a rush period, the cauliflower heads are cut and left inverted in the field for a short time. This checks the growth and prevents losses that might otherwise occur. Growers should always picture the appearance of the head at the time of arrival at market. Appearance is an important factor in the sale of any commodity, and even one over-mature head in a pack may spoil the appearance of the entire lot. Over-mature heads are very conspicuous because the advanced growth spreads the leaves and exposes the flower. Young ones are more concealed in their jacket leaves and, therefore, attract less attention. Leafy heads are those which have small green leaves appearing between the flower segments. Heads of this type are undesirable, and if possessing many leaflets, should be discarded. This condition is usually due to seed of poor quality.

So far, the chief problem of the cauliflower grower has been that of acquiring good seed. As a general thing the production of seed by the average grower is not to be recommended, because of the insufficient care exercised in the selection of the seed stock and in rogueing out the undesirable plants. Although a little seed has been produced by individual growers from good strains introduced from Italy and Holland, so far as is known no one has made a special effort to improve this stock. As a result, in those districts where cauliflower is an important commercial crop, opportunity awaits anyone who will make a specialty of breeding strains of higher quality and greater uniformity.

The best means of obtaining good seed is to reserve several well rogued rows on one side of the field, far removed from any other plants of the same family. Cauliflower is mostly insect pollinated, so the greater the distance the less the danger of cross pollination. Only the best heads in these rows should be allowed to develop. Often neighbouring plants too poor to cut for market are unintentionally allowed to bloom. These cross readily with the selected plants, and the progeny are usually worthless. Since cauliflower, and all varieties of cabbage, kale, Brussel sprouts, and kohl rabi cross freely, these crops should not be grown in close proximity.

It is sometimes necessary to cover the maturing plants with mosquito netting, so that birds cannot break open the pods and eat the seed. When the pods are brown in colour, the plants are cut and laid on large canvas sheets to dry. In two or three weeks, the seeds can be rolled out with a large wooden roller, or threshed out with a flail. The seed is then cleaned and placed in strong muslin bags. These bags are only partially filled so that they may be turned about every day for about two weeks and the seed cured thoroughly.

DENMARK WASTING DISEASE.

J. F. Filmer, Senior Veterinary Officer.
E. J. Underwood, Animal Nutrition Officer.

Denmark Lick No. 1 has now been tested sufficiently to enable the claim to be made with some confidence that it will both cure and prevent wasting disease when it is used in accordance with the instructions issued in the March, 1934, number of this Journal.

It has been used on the departmental experiment farm since November, 1932. Three Denmark settlers have been using it since August, 1933, and a number of others have been using it for shorter periods. Numerous cases of wasting disease have been cured and in all cases where its use has been systematically continued heifers have continued to grow well and cows have remained in good condition.

Wasting disease is not generally noticed in young unweaned calves but recent observations made on the experimental farm show that growth is subnormal unless they receive the lick. None of the calves in the following table showed obvious signs of wasting disease, but the difference in weights between those which did and those which did not receive the lick is very striking.

Lick.				No Lick.			
Calf.	3 Months.	6 Months.	10 Months.	Calf.	3 Months.	6 Months.	10 Months.
	lbs.	lbs.	lbs.		lbs.	lbs.	lbs.
33 ...	166	282	370	1 ...	141	240	304
34 ...	186	308	398	3 ...	186	257	351
37 ...	191	351	475	14 ...	171	288	307
38 ...	204	368	514	15 ...	181	280	324
87 ...	175	270	381	16 ...	167	269	349
Average...	184	316	428	Average	169	267	327

The effect on butter fat production has in some cases been equally striking, though this was naturally influenced very largely by the condition of the cows before the lick was administered. In some cases on affected blocks the cows retained their condition and milked well without lick. In these cases the effect of the lick was naturally not so striking as it was where the cows were in poor condition and consequently giving little milk. One settler during the year September, 1932, to August, 1933, sent to the butter factory 2,962 lbs. of butter fat from 13 cows. During the following twelve months Denmark Lick No. 1 was administered and 4,001 lbs. of butter fat was sent to the factory from the same number of cows, an increase of 1,039 lbs., or an average increase of 6.7 lbs. per cow per month.

The following table shows the increase which has occurred on properties where Denmark Lick No. 1 was fed for the first time this year. In all cases some at least of the cows were in poor condition during the months July to September, 1933. The figures represent the number of pounds of butter fat sent to the factory.

July to September, 1933.		July to September, 1934.	
Total Fat.	Fat per Cow per month.	Total Fat.	Fat per Cow per month.
lbs.	lbs.	lbs.	lbs.
95	6·3	91	15·2
185	9·8	458	16·3
626	16·9	934	22·3
464	15·4	723	24·1
364	17·5	855	21·9
93	7·1	398	16·6
84	9·3	329	18·3
58	8·3	469	20·4

In some cases it has been noticed that the lick is not being fed systematically. It is given at irregular intervals to affected animals and when these have improved in condition its administration is stopped. The best results cannot be obtained in this way. The lick should not be regarded as medicine but as part of the animals' food and should therefore be given regularly to all animals in the following quantities:—1 week to 6 months, ½ ounce twice daily; 6 to 12 months, 1 ounce twice daily; over 12 month, 1½ ounces twice daily. Putting the lick out in boxes is wasteful and uncertain and best results will be obtained by bailing all animals and giving the correct quantities in milk or dry feed.

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SUBTERRANEAN CLOVER.

New Strains from Northam and Muresk.

A. B. Adams, B.Sc. (Agric.), Muresk Agricultural College.

An apparently distinctly new strain of Subterranean Clover was noticed on the roadside at Northam in early September, and another, first seen two years ago, but temporarily lost, was rediscovered on the railway line at Muresk by one of the students. Still another very late strain was found by two of the students on the rich moist soil of the banks of Spencer's Brook, close to its junction with the Avon.

Tentatively, it is proposed to name these new strains: Muresk Early, Northam Midseason, Spencer's Brook Late.

Muresk Early.—Commences to flower early in August.

Description.—Differs from Dwalganup Early in the shape of the leaflet, and in the white crescent, which is more distinct and has less tendency to disappear in older plants. The calyx tube green with slight stippling of red at base of teeth, and teeth red.

Northam Midseason.—Commences to flower about the first week in September, approximately a fortnight later than Daliak Second Early, and a fortnight before Midseason.

Description.—Calyx pale green. Stipules green veins on white background. Leaflets have a distinct crescent mark that is almost white (in Midseason the mark is a pale green) extending to the outer edge of the leaflet. Over the midrib the mark is pale green similar to the mark in Midseason, and this is continued on each side by lighter crescentic marks to the margin of the leaf.

It has larger leaves and thicker stems than any of the early or second early strains.

Spencer's Brook Late.—Commences to flower about last week in October, later than Wenigup, as this flowers early October at Muresk.

Description.—Calyx pale green with green teeth. Stipules pointed as in Wenigup Late. Leaves very large with light crescent mark to margin of leaflets.

Shape of Leaflet in above Varieties.—It was noticed by the writer that the shape of the leaflet is a character of some importance in distinguishing the different varieties.

Illustrations are required to show all the differences in shape and markings. It is hoped that it will be possible to do this next season; in the meantime, the following are some examples of observed differences:—

Dwalganup Early.—Leaflet without, or almost without notch at apex; sides of leaflet rounded (between Midseason and straight sided wedge-shaped strains).

Midseason.—Notch at apex; sides of leaflet almost semi-circular.

Daliak.—Deep notch at apex; sides of leaflet so straight as to give an almost triangular or wedge-shaped appearance.

Of the new varieties or strains now described, the *Muresk Early* and *Northam Midseason* have the wedge-shaped type of leaflet. *Spencer's Brook Late* is rather rounded, but less so than *Midseason*. They all have the notch in the apex of the leaflet.

GENERAL MANAGEMENT OF SHEEP.

By Hugh McCallum, Sheep and Wool Inspector,
and
W. McC. Johnson, Cadet.

In dealing generally with a subject as comprehensive as the sheep industry, this article must necessarily be confined to brief references to main points of interest, any of which could quite easily be made the subject of an article in itself.

It will be generally admitted that the co-operation between the farming community and the Department of Agriculture is increasing every day, and the exchange of information has been of great benefit, and will be of greater benefit still. There are many important events that happen during the year amongst farmers which, if properly tabulated and inquired into, would solve many problems in sheep breeding. Sheep on the farm are necessary to enable the farmer to obtain the highest possible returns. Therefore they take a definite part in the production of crops.

Our State can become within a few years a very large producer of sheep and wool, but there will have to be changes in the methods of sheep breeding by many sheep owners, who do not conduct breeding as business men. We must try to produce a better type of sheep. Whilst the improvement in breeding is one of the main objects to be attained, the question of losses through neglect, incorrect feeding and other causes must be carefully studied, and means adopted successfully to combat them. Overstocking and under-feeding are outstanding faults of management and should not occur in this State, where reserves of feed can be conserved. A farmer should know the carrying capacity of the farm and stock accordingly. It is not numbers that count, but quality in sheep husbandry. The farmer should decide what type of sheep is most suitable for his district. To the beginner on the wheat lands merino sheep are recommended. They should be of good constitution and conformation, large-framed and growing fleeces of good commercial value. As production is the main factor in sheep breeding, watch carefully that the flocks do not go back and lose their former vigour through the introduction of the wrong type of rams. There are rules to be observed by every farmer in sheep breeding, and one of the most important is not to breed from extremes, a practice which has unfortunately been followed by many breeders.

Our Agricultural Shows have done much to assist the sheep farmer, and instruction is now better disseminated. Whilst good progress has been shown in this industry there is still much to learn, not only by the ordinary farmer, but also by the more progressive man. The improvement of the flocks requires much patience and perseverance, and a fixed idea in one's mind of the object to be attained. The farmer should become a good judge so as to notice the bad, as well as the good points in sheep. He must know his flock intimately and what he wants and what he must cull from the flock. The farmer who fulfils these requirements can accurately describe the kind of rams required for his flock. The more you look after the flock the stronger and healthier will be the offspring, and they, remember, are the future flock. Keeping sheep clean before and after lambing is very necessary. Change them to different pastures, also give them the elements that are deficient in the soils by means of licks, etc. These add to the general health of the flock.

(Published by courtesy of the Australian Broadcasting Commission, being an educational talk given through Station 6WF.)

Selecting the Rams.

The important business of selecting suitable rams to mate with the ewes calls for attention. In doing this, the general character of the flock must be borne in mind and also the faults and blemishes that must be eradicated as far as possible in the next generation, and to this end the rams purchased should be exceptionally strong in those points where the ewes are faulty, otherwise the results will not be very satisfactory. Carefully observe the important points of *good* quality, pure breeding and good constitution. These qualities a ram must possess, along with as much style and finish as it is possible to obtain. It is on the ram that so much depends as regards the quality of the future flock. It is essential to examine closely the way the animal stands. Some rams stand square on their feet; others are very faulty, and notice should be taken to see whether there is any inclination to weakness in the hocks and hind legs. Straight hocks and good action are outstanding points of a well-bred ram.

Selecting the Breeding Ewes.

Often the farmer does not realise the importance of the ewes in building up a flock to the ideal aimed at by the breeder. They should be carefully selected for their requisite qualities. Leading characteristics which ewes should possess are constitution, good quality, soundness in type, vitality and fertility. With sound vitality the ewes can stand reverses, but should be looked after, especially during gestation and at lambing time. Fertility is essential. No ewe that has failed to produce lambs should be kept on the farm. There are too many unproductive ewes retained, year after year, for reasons difficult to understand. Good lines of cast for age ewes can be purchased off shears. They are generally a very even line, having been retained by the breeder for several years. Each season after shearing the older sheep are sold, the younger ewes taking their place. These sheep can be recommended, and providing they receive fair treatment will, when mated to rams of quality, produce high-grade sheep. Most of the good flocks pastured on the wheat lands were bred from cast for age ewes.

Broken-mouthed sheep, even though they are cheap, should never be purchased. It is wise not to haggle unduly over the price required by the vendor of good sheep. Bear in mind the time, cost and work involved in breeding a uniform flock. By starting on sound lines many years of unprofitable work in selecting, mating, breeding and culling are saved, besides the usual disappointments the good breeders experience. Success or failure will depend entirely on the farmer's own ability.

Both the rams and ewes should be in good condition before mating. Sheep that are poor throughout the year, cannot produce good lambs, and under these conditions the percentage is always low. The offspring never get a chance to develop into sheep which compare with flocks that are fed evenly throughout the year.

Culling the Flock.

Before shearing every year the flock should be classed with the exception of the lambs. The object of classing is to remove all the undesirable sheep that do not come up to a certain standard. The average farmer can, with a little judgment, cull many sheep from the flock that are unprofitable to retain. The percentage of rejects will greatly depend on the standard of excellence set in the flock. As the flock improves, the percentage lowers and the quality of the rejects is higher. The unprofitable sheep should be fattened and sold.

Lambing Season.

The number of lambs raised largely depends upon the care given by the breeder to the flock during the lambing period. The points to be remembered by him are constant daily attention to the ewes and looking after the new born lambs insufficiently strong to help themselves.

Undulating country is the best for lambing. It enables the ewes and lambs to escape exposure to cold winds. Shade and shelter are also a benefit. The increased number of lambs and the value of the sheep will repay the extra care during the lambing season.

Lamb Marking.

The safest time for lamb marking is cool dry weather. The lambs should not be driven fast before or after the operation. If this is done losses from bleeding will be far more likely to occur. Cleanliness should always be studied. Knives and other implements used should be constantly steriliised by dipping in a good antiseptic, and the ewes and lambs returned to the pastures as soon as the lambs are mothered.

Weaning the Lambs.

Allow the lambs as long as possible with their mothers and always reserve a paddock to receive the weaners, spelling it for some time previously. They should have a paddock with the greatest variety of feed. It is necessary that the young sheep should keep developing, as they never rightly recover if once they receive a set back. When separating the lambs from their mothers do not leave them entirely alone. A few dry ewes with the weaners will steady them down.

Tick and Lice.

This is a matter of vital importance to the sheep industry which every farmer must recognise. He should be constantly on the alert to see that the flocks are free from infestation. The value of dipping is considerable. Wool free from tick naturally brings higher prices than when infested with parasites.

Combating the Blow-fly.

The blow-fly pest, which annually involves breeders in heavy losses, has long since become a source of serious trouble to the sheep industry. Some years the mortality is much greater than others, due largely to more favourable weather conditions for the breeding of flies. Just before lambing time and during the wet season is the most dangerous period of the year. Breeders should watch the flock for any sheep affected and attend to same at once. A good method of prevention of the trouble is to crutch all the sheep by removing from the hind parts all stained wool, and apply dressings for prevention.

Maintenance.

Every effort should be made each year in some way to improve production, otherwise deterioration will set in, and if neglected, will increase every year. The farmer cannot expect to take everything from the land without returning a portion of what he has taken out, in some form or another. Besides a utility shed for shearing, there should be good yards with a drafting race. This will save considerable time and money, the cost of which will be repaid in two or three seasons.

SUBTERRANEAN CLOVER.

Response of Different Strains to Seasonal Conditions.

A. B. Adams,
Muresk Agricultural College.

The season 1934 has been unusual, as there was sufficient rain in March at Muresk to germinate clover seed, followed by rains that kept the plants growing. Usually, the first useful rains are in May, and this seasonal difference has afforded an opportunity to observe the effect of the difference on the time of flowering of various strains of Subterranean Clover.

The early strains were stimulated into earlier flowering than usual; Dwalganup Extra Early and Burlong (Northam First) Early produced some flowers at the end of June, and were flowering prolifically in July. Their earliest flowering time in a normal season is during the first week of August.

The later strains as Daliak and mid-season made little, if any, response to the early rains, in the way of earlier flower production, although they made more leaf growth than usual during early winter. Daliak commenced flowering about the third week in August and midseason three weeks to a month later. These are the usual flowering dates for these varieties.

It is suggested as a possibility that the earlier varieties are short day plants, or at least do not need a long day in order to produce flowers, and that the later varieties require a certain length of day before flower buds are formed.

The time of flowering of the early varieties in our conditions is regulated by the time of the first useful rains, *i.e.*, time of germination, but in the case of the later varieties, by the amount of daylight.

DAIRY CATTLE IMPROVEMENT ACT, 1922, AND AMENDMENT ACT, 1932.

Registration of Bulls.

G. K. Baron-Hay,
Superintendent of Dairying, Department of Agriculture.

With present world prices for butter-fat as they are and indications that, perhaps not immediately but at some not far distant date, dairy farmers in Western Australia may be forced to accept prices for their dairy produce more in conformity with those in the Eastern States owing to the increased production, it is of more importance than ever before that the average production of cows in the herds should be increased. The results obtained from the testing of cows in 1933 under the Grade Herd Recording Scheme, showed that the 4,000 cows tested averaged 181 lbs. butter-fat in comparison with 140 lbs. which is the State average.

It was also most striking that the higher averages were secured by those herds where the use of pure-bred sires ex tested dams had been the policy of the owner for a number of years. The number of pure-bred bulls owned by farmers testing under the scheme was approximately 70 per cent., in comparison with only 56 per cent. for the State.

This latter figure, however, is a great improvement on that which obtained when the registration was first enforced in 1925, when only 23 per cent. of the registrations were pure-bred bulls. See Graph.

The enforcement of the Act, therefore, is not a hardship to those farmers who are endeavouring to improve their stock, and as assistance is given by means of the Subsidy Scheme for the replacement of undesirable bulls by herd-book registered animals from high-producing females, no farmer should complain against the administration of the Act requiring the registration of the dairy sire.

In the case of pure-bred bulls, registration is for life, the fee being 10s. per head, whilst grade bulls must be registered annually, the fee being 5s. for each application.

Farmers are *reminded that registrations are due on the 1st January*, 1935, each year in the case of grade bulls and on the same date for pure-bred bulls which must be registered for life. Information regarding transfers, de-sexing, or slaughter of any registered bulls should be forwarded to the Department immediately, particularly in the case of life-registered animals, in order that the records may be kept complete.

LEMON CURING.

Geo. W. Wickens,
Superintendent of Horticulture, Department of Agriculture.

PICKING.

Gather the fruit when it reaches a diameter of 2½ inches, and while still green or yellowish green. Do not store fruit which is fully yellow and tree ripe.

Each lemon should be clipped (not pulled) from the tree in such a manner as not to remove the "button," and this can best be done by making two cuts—one when severing the fruit from the branch and another shortening the stem to about one-eighth inch in length before placing in picking box. Great care must be exercised when picking to prevent injury to the skin of the fruit, any abrasion of which is almost certain to result in mould infection.

Do not tip the fruit from a picking box into a sweat box, but handle each fruit separately throughout the operation of gathering and storing; best results will be obtained if the pickers use gloves and the picking boxes are padded.

No lemons should be stored which show skin blemishes from limb rubs, thorns, etc.

SWEATING.

After the fruit is gathered it should be placed loosely in boxes—petrol cases are suitable—and stacked in a well-ventilated shed from three to seven days according to weather conditions being dry or damp, so as to allow the fruit to dry off, *i.e.*, "sweat."

STORING.

When sweating is completed, the fruit can be stored for curing in several ways, according to the number to be treated and the facilities the grower is able to afford.

Method No. 1.—Wrap each fruit in sulphite tissue paper—apple wraps—and pack loosely in cases lined with paper at bottom and sides and doubled over the top. Stack in a cool dark shed which must not be draughty. If shed cannot be darkened and draughts eliminated, cover the stacks of fruit with canvas sheets or bags, and during the early period of storage raise same occasionally at night,

preventing, as far as possible, great variations in temperature and humidity. Examine the fruit 14 days after storage, removing any showing signs of mould. This can be discerned without unwrapping the lemons. Examine again at later periods, the time of which will vary according to condition of fruit, but if it has been handled with care throughout, very little decay should be found.

Method No. 2.—After sweating, wrap each fruit in sulphite tissue paper. Line the storage cases with paper and pack fruit loosely in these, using chaff as a filler as follows: Just cover the bottom of the case with a layer of chaff, place thereon a layer of lemons; then fill spaces between and cover fruit with a further layer of chaff; then another layer of lemons, and so on until case is filled. Stack, handle and examine in shed same as advised for cases packed without chaff.

Method No. 3.—After sweating, place the fruit loosely and unwrapped in storage cases lined with paper. Stack cases in shed free from draughts in blocks of 40 to 50 and cover these with canvas tents. Place a dish of water inside each tent, thus maintaining humidity and preventing excessive shrinkage by evaporation of fruit. If drops of moisture appear on surface of fruit, raise the sides of the tents until these have disappeared; then drop again into position. Examine the fruit periodically for mould infection.

Method No. 4.—Underground cellars, if properly constructed, make satisfactory storage places, but require careful attention in preventing moisture from oozing through, or collecting on the walls and floor during winter rains, and an air circulation which will allow of gases given off from the fruit being carried out of the chamber must be provided.

Finally it must be remembered that no matter what method of storage is adopted, none will be successful if the fruit has been bruised or the skins scratched. Gathering the fruit at the right time and avoiding skin injury are essentials in successful lemon curing.

VERMIN POISONING.

A. Arnold, Chief Inspector of Rabbits.
G. Herbert, Trapper, Vermin Advisory Board.

VALUE OF POISONING.

In dealing with the destruction of vermin of all kinds, it is well to know that poisoning is the most efficient method to employ. This applies to dogs and foxes equally as to all other vermin, and no district can be effectively cleared of these pests without prolific use of poisoned baits.

Trapping, hunting, shooting and other methods, although of great value, usually provide only temporary relief, but the silent and deadly method of distributing poisoned baits all the year round must eventually bring about definite and lasting results. It also has the added value of not interfering with any other method employed.

Poisoning should be regarded as a first line of defence, to be continuously carried out all the year round over a wide area. Further, poisoning is a very useful ally of trapping, and should be used in conjunction with it, particularly in new country. Settlers who suffer from dingo attacks, in addition to using traps intelligently, and therefore efficiently, should acquire the poison habit as applied to dingoes, foxes and eagle hawks. After poisoning has been carried out, trapping may be employed as a second line of attack.

Many trappers ridicule the idea of poison being used, but it is very significant that it is extremely difficult to persuade a trapper to operate in a well-poisoned district. In such districts these men often spend a lot of time and trouble setting traps only to find that the animal or animals they are after have disappeared. Very often the carcase of the animal is found weeks, or even months, after it has disappeared, as the result of being laid low by a bait. Many are never found; in fact, even under the most favourable circumstances, if 30 per cent. of poisoned animals are located, it is considered a good average, while in heavily timbered or rough scrub country, 15 per cent. would be a fair proportion even for the most optimistic and skilful poisoner.

STRYCHNINE.

There are several important features connected with poisoning not sufficiently well known by those who use or intend to use this method for eradicating vermin. These are: firstly, the most suitable poison to use; secondly, how to apply it; and finally, the size of the dose in order to obtain the most satisfactory result.

Strychnine is considered the best poison to use for dingoes, foxes and eagle hawks. It is rapid in its action and does not deteriorate, so that, whilst the bait poisoned with strychnine remains intact, it is still effective.

When using strychnine, however, it is well to remember that it is a deadly poison and certain precautions should be observed. It should not be removed from the original container in which it is received, except for immediate use, but if for any reason this is necessary the new container into which it is placed should immediately be labelled. Where any measure is used, it should be thoroughly cleaned immediately after use. The observance of these precautions may appear to be unnecessary, but may avert a tragedy.

Strychnine is sold either as free strychnine or in combination with an acid. The forms resulting from the combination of strychnine with an acid are known as the salts of strychnine and are sold in the trade under their special names, such as strychnine sulphate, etc. These are regarded as soluble strychnine. The free strychnine is known in the trade as "alkaloid" strychnine and is practically insoluble. The alkaloid is the form recommended for vermin destruction and especially for dogs and foxes. The free strychnine is only slightly soluble in water (1 part of strychnine dissolving in 6,000 parts of water) and may be called insoluble strychnine. The strychnine salts have solubilities from 1 in 40 to 1 in 70, and are often referred to as the soluble strychnines. As manufactured, free strychnine is in the form of large crystals, while the salts form crystals so small that they are often referred to as "powdered" strychnine. Since grinding the crystals to powder does not change the composition or solubility, this method of distinguishing between free strychnine and its salts is unreliable and likely to lead to some confusion, as manufacturers are sometimes requested to grind the crystals before sending them to Vermin Boards.

If it is desired to know whether certain strychnine is strychnine salt or powdered crystals, the best test is to place a small quantity in a test tube or similar small container of water. This should be left overnight, and if it is then found to be dissolved in the water, it is strychnine salt.

In this article, where "powdered form" is used, strychnine salts are meant and not fine-crushed crystals.

Both forms are prepared in two colours, red and white. The natural colour is white, the red colouring being added as a precaution for safety purposes, and to prevent its being used as a baking powder, etc. The colouring has no effect on the toxic properties of the strychnine, and the coloured forms should always be used; the prejudice against it being entirely unwarranted. Strychnine is usually put up in 1 ounce bottles or containers, the crystal form being a smaller package and, bulk for bulk, is 20 per cent. more deadly than the powdered form. Because of this it is necessary to add a little more per bait than when the crystal form is used. When the crystal form is used it is a good plan to grind up the crystals to avoid the possibility of their falling out of the bait. This can easily be done by crushing the material against the side of the containers with a knife.

ACTION OF STRYCHNINE.

Strychnine in both forms is readily dissolved by an acid, and the acid of the gastric juices in the stomach dissolves the strychnine, which is absorbed by the system, thus causing death. The first effect is to cause a vomiting sensation in the stomach. Some are of the opinion that a little bi-carbonate of soda (baking soda) added to the strychnine quickens its action, causing the animal to die close at hand, but the addition of soda would, if anything, tend to delay the action of the strychnine, because its effect would be to temporarily neutralise the acid in the stomach so necessary to dissolve the drug. Once this neutralising action was overcome, however, the strychnine would do its work. Possibly, the soda, through its settling action on the stomach, would prevent the animal from vomiting.

Strychnine is very bitter to the taste, and if raw meat or liver is used, the acid in this type of bait will render some of the strychnine soluble. In consequence, the animal will be able to taste the poison, and this will often cause it to drop the bait. Here again the soda would possibly be of value by neutralising the acid effect. In cooked baits, or baits of fat, suet or an oily nature, where no acid action exists, it would be of no value. For those who desire to use soda it may be stated that half an ounce of soda to one ounce of strychnine is the correct mixture.

After swallowing a bait, a dog or fox will often travel a long way before the strychnine takes effect. It has been noted, as the result of a post mortem, that whenever this has happened the animal always had more food in the stomach than was supplied by the bait. The strychnine does not come into contact with the gastric juices of the stomach till the digestive organs assimilate the bait. If, therefore, other food is eaten before the bait is taken, the latter will remain intact and the strychnine lie dormant till the former is digested. An animal with a full stomach may live for some hours, and travel some distance before the strychnine does its work. When this happens, it will be found that the animal dies very shortly after the strychnine takes effect. It is the animal which vomits shortly after taking a bait which recovers. With dogs and foxes, the first indication of the strychnine operating is a dragging of the hind legs, with a staggering gait, followed by a fit. One may be sure when this happens the carcase of the animal is not very far off. A drink of water often has a hastening effect, hence the value of poisoning near watering places.

TOXIC DOSE.

It is not an easy matter to state definitely the toxic dose of strychnine for any animal, as the action will vary according to its size and condition. An empty stomach, a young animal or one in a weakened condition, all offer conditions fav-

ourable to quick action. Dogs are particularly susceptible too, and are easily affected by strychnine. The recognised toxic dose for a dog the size of a dingo is one-third of a grain of strychnine, i.e., strychnine without admixture of soda, etc.; this amount when finely ground up, will just cover half an inch of the small blade of an ordinary pocket knife, or as much as will cover a threepenny piece thinly. If the strychnine is heaped up on the threepenny piece so that it holds as much as possible, the weight is three grains or enough to poison nine dogs.

In using the sulphate or powdered form, or ground crystals, with soda added, it is necessary to increase the dose, say, as much as would comfortably lie on three-quarters of an inch of the knife blade. It is possible to err on the side of giving too small a dose, when the animal will recover and live to remember the pain suffered and refuse baits. On the other hand, many trappers, taught by practical experience, declare that an over-dose cannot be given. Possibly this is incorrect, but it is evidently better to be liberal with the quantity given to ensure that the animal will receive sufficient to kill it.

TYPE OF BAIT.

With regard to baits, one must be guided to a large extent by the natural conditions in the locality. For instance, if a dog's natural food is mainly kangaroo, it has been found that poisoned emu baits will be more readily taken. Experience has proved that good results are obtained from baits composed of mutton, suet, fat, pork, brains, kidney, liver, fish, sardines and sardine tins with oil in them. Flesh of any kind can be used and cooked meat frequently makes a better bait than fresh meat. Birds such as parrots, etc., are an excellent bait for foxes; the heads of turkeys and fowls which have been killed for domestic use are also very good.

For general use, however, suet or fat has many advantages over any other type of bait. In the first place, because both the dog and fox are fond of fat, owing to its scarcity in bush game; secondly, because it does not deteriorate as readily as meat or liver (in fact, in cool weather, or if placed in shady places in hot weather, it will keep for quite a long time); and thirdly, owing to the fact that strychnine is very bitter to the taste and readily dissolved by an acid, when meat is used, as previously mentioned, the acid juices contained in the meat may dissolve the strychnine and enable it to be tasted by the animal, causing it to drop the bait. This does not occur with suet or fat, the strychnine remaining in its original form, and, if the bait is carefully prepared as described later, it will be readily taken and swallowed. A further decided advantage of fat baits is that they rarely attract ants. Ants will readily attack meat and even though they will leave it after a time, or at night, the smell or the ants remains on the bait. Both the dog and fox hate the smell of ants, and this is often the reason why baits are left untouched. Ants are not fond of anything oily or greasy, and will do little if any harm to fat or suet baits. This also applies to fat or butter used in tins, also to fat baits rolled in paper. Ants are amongst the worst enemies the vermin poisoner has to contend with, and it will be readily understood why the suet bait is so favoured by him.

PREPARATION OF BAITS.

In preparing baits it is important to realise that the smaller the bait—provided it is large enough to hold a good dose of strychnine—the better it will be. A small bait is not only more readily taken than a large one, but it ensures the animal getting sufficient poison to destroy it. A bait about the size of the top joint of a man's thumb is ample for this, and the material used for baits should be cut

accordingly. A deep incision should be made in the bait and the strychnine inserted, taking care not to leave any on the outside. If liver or meat is to be used, it is better to cook it sufficiently to harden it.

After making baits it is a good plan to dip them in melted fats. To do this impale the bait on a stick, or piece of wire, dip it in the fat, draw it out, and then hold it in the air to cool. After dipping two or three times in this way the fat will form a coating over the bait. This helps to preserve the bait, making it more tasty and seals the cut. Another method of making the bait attractive is to slightly roast it over a fire. Whilst referring to fires, it may be stated that dogs and foxes frequent spots where camp fires have been, either to gather up what might have been burnt or after game, also seeking food. Therefore, these places should receive attention for poisoning.

Dripping is another good medium for conveying poisons: 1 oz. of strychnine will poison 12 lbs. of dripping. The strychnine should be stirred into and thoroughly mixed with the dripping whilst in a melted and liquid state. A dessertspoonful of the poisoned dripping placed on paper either left loosely or wrapped up and placed along the trail or beneath leaves or grass, or left in tins around old camping places and waterholes, will very often prove effective. Handle the baits as little as possible. This, however, is not so important as many people think, as the sun, wind and rain will have their effect and remove any slight smell of handling in a few days.

CARCASE POISONING.

A common method, employed particularly by farmers in the wheat belt, is to insert strychnine in a carcase of a sheep killed by dogs or foxes by making knife cuts in the flesh and working strychnine into these cuts. Sometimes this is successful, but more often than not no result is obtained, and such farmers condemn poisoning as useless. They are not aware of the fact that once an animal becomes a killer he acquires a taste for warm flesh of his own kill; therefore, he is a very difficult animal to poison on his hunting ground. When he enters a paddock he does so with a definite purpose in view, that is, to kill and afterwards to satisfy his hunger from the carcase of the sheep he has attacked. If, therefore, live sheep are available he will not trouble the carcase of a previous kill. He does not, as a rule, remain in the paddock any length of time, but after completing his ruthless slaughter, returns to the safety of the surrounding bush, which is his natural haunt.

Under these conditions, carcase poisoning is therefore of little if any value. It also has other disadvantages. It takes a large quantity of strychnine to effectively poison a carcase, which really provides a large quantity of food which is not required. Often an animal tastes the strychnine which causes him to eat away from the poisoned part. By doing this, he obtains insufficient strychnine to kill, together with a considerable portion of the meat; this will probably cause him to vomit, thus getting rid of the strychnine and allowing him to escape. These are some of the reasons why carcase poisoning does not obtain the result desired. In the event of carcase poisoning being adopted it is better not to smear the strychnine thinly in a long cut, but to make small holes in various parts of the carcase, inserting a good dose of poison in each hole. If the animal eats this particular portion he will receive sufficient poison to destroy him. Further, when a carcase is poisoned it is a wise plan to use the additional method of distributing a number of small baits around the carcase, for a dog will often take a small bait more readily than a large one, and if he swallows a small, well-poisoned bait, he will surely die, even if he eats a large quantity of food before the poison has time to take effect.

WHEN TO POISON.

The question naturally arises, when should poison baits be laid? The obvious reply is whenever the vermin appears. This is quite in order so far as the individual application is concerned, but collective or wholesale poisoning, as would be undertaken at the instigation of the Vermin Board, say, for foxes, is best carried out at certain periods of the year. For instance, it is more important for sheep breeders that a concerted attack be launched against the pest in March, before the lambing season commences. If wholesale poisoning is undertaken an immeasurable amount of good will undoubtedly result, and the Board that organises a systematic attack, and ensures that its instructions are carried out generally throughout its area, can be assured that the losses of lambs from foxes will be materially minimised.

Then there is the mating and breeding season from May onwards. Early pups commence to arrive in July in a normal season and are caught up to the end of the year. For the greater portion of the year the main objective of both the dog and fox is self preservation. His mind and whole being is governed by this instinct, but during the mating season his attention is diverted. Soon after the early rains he commences to move about. There is the seeking of a mate and rivals to combat. A little later there is not so much travelling. A settling down and change of habits takes place. The vermin are then usually running in pairs, the female carrying young and not so alert from a hunting point of view, and therefore more likely to feel the cravings of hunger and more readily to pick up baits, in which case the litter is never born. It is more than probable also that its mate will hang around and will also fall a victim to baits, if plenty are laid. When the young come along there is continuous hunting to provide for them: full advantage should be taken, therefore, of the varying conditions, and any co-operative effort will give best results if launched during these periods, and particularly when the young are roaming about together.

Never lose sight of the fact that a dog or fox is always on the lookout for danger. Instinct, example and experience all tend to make him suspicious of anything unusual and treat it with respect. He always trusts his nose and everything has to be approved by that delicate organ.

The usual breeding places are in rabbit warrens, caves or rocks, hollow logs or trees and thickets. Sometimes they are found under overhanging trees on the banks of rivers, creeks or watercourses, gullies and cliffs or similar protected places. Fox cubs are even found in open sandplain, usually on the side of a slope. The mother will camp on the higher ground above the lair, and, when she detects danger approaching, will slink away along the ridge, in full view for some distance, and finally disappear over it. Evidently her maternal instinct teaches her to draw attention to herself and entice the approaching source of danger away from the lair. Dogs and foxes do not, as a rule, camp with their young, but visit them night and morning to give them food and drink. In the outback areas it is common for dogs to "box" their litters, particularly young sluts with their first litters; that is, to camp all their pups in the one place. As many as five litters have been found mixed together in this way, the pups varying in age from a few weeks to three months. Pups are seldom found more than two miles from a good supply of water, and in the dry areas outback are usually easy to locate for this reason.

WHERE TO LAY BAITS.

In selecting places to lay baits one must be guided to a large extent by the tracks of the animal. Speaking generally, baits should be laid along their definite routes of travel, in the location of which it should be remembered both dogs

and foxes naturally take full advantage of cover and follow creeks, gullies, along old roads, tracks, pads, etc., also around old camping grounds, waterholes and old carcases, or indeed in any place frequently visited by the dogs or foxes. In large open pastoral areas it is necessary to lay baits for miles outside of the run, for by this means the young and inexperienced animals are cleared out and dealt with before they come in on to the holding. Their feed under natural conditions is less easily obtained than when amongst the flocks, and baits are therefore more readily taken.

TRAILS AND DEPOTS.

An excellent plan for systematic poisoning is to drag a trail through the area to be poisoned, leaving a scent which a dog or fox will invariably follow from mere curiosity or from sheer hunger. The best type of trail to draw is a sheep's paunch or the carcase of a kangaroo or emu, the fatter the better. Some prefer charring or singeing the flesh. This gives it an odour which is attractive, and has the tendency to bring the fats to the surfaces, and fats, besides being particularly appreciated by both dogs and foxes, tend to give body to the scent and prevent loss of the scent from exposure or rain. It is not suggested that anything of a "decoy" nature should be added to the trail. Many are inclined to add aniseed and other strong smelling decoctions, which, though they are perhaps useful to draw a dog's attention to lure him into a trap, are best left alone where baits are concerned. A strange smell, especially on meat, is immediately conveyed to the dog and everything must be approved by his sensitive nose; any other than the natural smell would indicate danger and be left alone. For this reason strong smelling drugs or decoys are to be avoided.

After the trail has been laid, baits of a tempting nature and inviting odour should be laid at intervals of about 100 yards, and, where foxes are prevalent, and the trail is dragged through sandy country, the baits may be buried just under the surface, and the trail again dragged over the buried baits. The foxes follow and dig the baits up.

Another good plan in connection with laying baits is known as the depot method. Under this method a suitable site is selected and made a depot for carcases, bones and other rubbish. It is stated that by placing a carcase or a few bones at the site and adding to these from time to time they will form an attraction to vermin and, if a liberal dose of small baits is laid round this depot from time to time, this method is very effective. The top of a hill, old camping grounds, soaks or watering places are the most suitable sites to form depots. In the inland pastoral and desert areas excellent results from this method have been obtained by simply shooting a kangaroo here and there, and placing the carcase near a waterhole, soak or other likely place to start the depot. Other food matter can be added occasionally and, after the animals have formed the habit of visiting these places, both poisoned baits and traps can be used with great success. This method has much to recommend it. A settler can concentrate on certain spots in his locality, where there is little chance of doing harm either to his own or other people's animals. By guarding these spots, which may be termed "danger zones," a settler can effectively and efficiently guard his livestock from the depredations of the dog and fox, and save himself both time and expense by obviating the necessity of working throughout the surrounding country.

FOX POISONING.

The increase of the fox in Western Australia is the subject of a good deal of discussion, and many people are of the opinion that they do more good than harm. In some districts, where sheep farming is extensively conducted, there are

Vermin Boards who have asked that the bonus on foxes be discontinued, and the amount thus saved added to the wild-dog bonus. They consider that the destruction caused by foxes amongst poultry and lambs is more than compensated for by the value of their assistance in destroying rabbits, of which they undoubtedly take a heavy toll for many months of the year. There are others, however, who consider that the day is past for giving the fox the benefit of the doubt. The fact remains, foxes are very destructive once they acquire a taste for lambs, and pastoralists must deal with them to protect their flocks.

The haunts of the fox are to be found around the thickly wooded cover adjacent to rivers, creeks, swamps, lagoons, or in boulder-strewn country, where there is plenty of protective cover and along ridges frequented as a lookout, and especially where there is abundance of game, rabbits, etc. They move about mostly at night and live in hollow logs, crevices, between rocks, and such-like places. These are the places to lay baits. Foxes are not difficult to poison if care is taken in the preparation of baits. Baits similar to those prepared for dogs may be used, and in addition to these, birds, especially parrots, are particularly attractive to foxes. If birds are used for baits the poison should be inserted through the beak, making sure it is well down inside. This form of bait is not removed by crows or other birds and will tempt the fox even when dried up.

POISONING EAGLES.

The wedge-tailed eagle, commonly known as the eagle hawk, is the largest and easily the most destructive of all our birds of prey. The average measurements of a normal adult bird are from 7-8 feet span across the wings. Many people mistake several other species of the hawk family for the wedge-tail, particularly in flight, but no one who has had the opportunity to examine an eagle closely should ever mistake any other type of eagle or hawk for this one. It is outstanding in size in every way; body, wings, head and talons are so much larger than any other type, that for this reason alone it is easily recognised. Even the young birds in the nest are abnormally large about the head and feet, much bigger than the average full-grown hawk before they reach the feathered stage. They have other peculiarities as well, but the size alone should be sufficient for the average person to readily recognise the eagle from the other species.

These birds do a great deal more harm than is usually credited to them and in some parts of Western Australia, as well as the Eastern States, are a greater menace to sheep than either the dog or fox. Usually the greatest losses occur during the lambing season, but grown sheep are often attacked by eagles.

Eagles are not prolific breeders. They lay once a year, one egg being the usual clutch, two are somewhat uncommon and three, although not unknown, are exceedingly rare. They invariably lay in or adjacent to the same nest every year, and build their nest in a tree or on a high projecting cliff. Some of these nests are huge affairs, over ten feet across and built of sticks of various sizes, some three or four feet long and two inches in diameter. Their hunting is usually done early in the morning or near sundown, and although they are often about and flying at a considerable height on a cloudy day, the early morning appears to be the eagle's most favoured hunting period.

Unlike the dog and fox, carcase poisoning gives the best results with eagles. It is important, however, always to use small baits on or around a carcase as with dogs and foxes. Trapping is also useful and the eagles may be caught by setting traps around a carcase. As the eagle's method of travelling is by air, the more elevated positions are the most suitable places to poison or trap them, for they

will often alight on a high hilltop, when otherwise they would pass on. A good plan is to select as a site the top of a rise or hill, the higher the better. In open country it is also advisable to place a carcase near a tall tree, if such can be found. The carcase, of course, is the decoy, and the hill top, large rock or tree acting as a secondary measure to entice the bird to the spot. It is also helpful to burn a small area a few chains square at the site, fires and fire-burnt country proving a great attraction for hawks and crows, because a great many of the smaller vermin, such as lizards, snakes, mice, etc., are often destroyed by fire and provide food which is a welcome contribution to their daily fare. Eagles prefer fresh food and old carcases are of no value for baits.

The method recommended for poisoning or trapping eagles is to secure a freshly killed carcase (do not burn it) and place it at the selected site as late in the evening as possible, leaving it where it can be easily seen. The carcase will then be quite fresh the following morning. Some years ago a station on the Upper Gascoyne was newly converted into sheep country, and the first year from 5,000 mated ewes there were less than 10 per cent. of lambs, due to the depredations of eagles during the lambing season. The station manager obtained a supply of strychnine and, game being plentiful, he toured the surrounding country for some weeks in a motor car, shooting game and poisoning it for eagle hawks throughout his tour. Over 600 eagles were accounted for in a few months and the following year some 80 per cent. lambs were marked. No serious lossess through eagles have occurred on this property since.

Rabbits form the chief diet of the eagle in the wheat belt, but the same argument applies with the eagle as with the dog and fox: once the eagle acquires a taste for fresh killed lambs, he is a menace till he is finally destroyed.

CONTROL OF DOMESTIC DOG.

The control, or perhaps a better term would be the lack of control, of the domestic dog plays a far more important part in vermin infestation than many people realise. The working sheep or cattle dog kept for a useful purpose must of necessity be kept under control, otherwise it soon becomes of little value. This type of animal is an asset not only to its owner, but to a district; not merely for its work alone, but for breeding purposes, and there is always a keen demand for the progeny of these animals in any districts. The trouble arises from the nondescript, ill-bred, usually underfed type of creature which is allowed to roam at will, uncontrolled and uncared for, often forced, through ill-treatment and lack of nourishment, to wander into the bush or on to another person's property to fend for itself. It also occurs in places where settlement has moved on or been abandoned, such as timber workers' camps. In the South-West timber areas and other places, unfortunate dogs are left to fend for themselves as best they can. During the breeding season even well-fed and kindly treated animals answer the call of Nature, and seek a mate in the bush. In this manner many types of crossbreds are bred, often of a very formidable nature. Any dog, after living for some time in the bush, naturally reverts to a wild state, and by breeding with the wild dogs with which he associates, establishes a breed which becomes a curse and a menace. The Collie, Kangaroo dog and Alsatian establish a particularly ruthless, dangerous, and daring type of animal. So pronounced has the crossbred strain become of later years, particularly in the more settled regions, that the original name "Dingo" is becoming a farce, and the term "wild dog" used in its place.

Although pure-bred dingoes are still to be found, chiefly on the fringe or outside of settlement in the inner areas, the crossbreds of the near domestic dogs pre-

dominate, and the dingo strain is slowly but surely dying out. These creatures cost Australia many thousands of pounds every year both in bonus payments and losses in sheep and livestock of other kinds. Instances of foals and yearling calves being torn to pieces by several of the more vicious and daring type of crossbreds are not uncommon. Settlers, therefore, would be well advised to keep strict control of their domestic dogs, restrict their breeding to a minimum, and assist their local vermin officers whenever possible in the destruction of stray animals. If this were done, many thousands of pounds would be saved annually. It is little use spending thousands of pounds to eradicate the wild animal, when other dogs, often of a worse type, are being bred and allowed to roam at large to take its place. It takes little of the wild strain to keep the breed going where wandering domestic dogs are numerous, but if efficient control were kept over these, the wild strain would soon cease to exist. Under the existing conditions, however, it will be many years before the wild-dog menace is finally overcome. The problem is a huge but not impossible one, and is essentially a community rather than an individual task, though each individual has his or her own responsibilities. It is necessary, therefore, for all settlers to acquire the poison habit, learn to use traps intelligently and efficiently, and control the domestic dog. When this is done the solution of the problem will be well within sight, and each year bring near the ultimate goal—the extermination of the dog and fox. It will be a wonderful day for Australia when the stock owner can leave his flocks to graze in the pastures and rest assured they will be immune from the attack of the wild dog, the wandering domestic dog and the fox.

DESTRUCTION OF WILD TURNIP SEED IN SECOND-HAND BAGS BY CHEMICAL MEANS.

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Of recent years second-hand bags have played an increasingly important part in the spreading of wild turnip (*Brassica Tournefortii*; *Gouan*) from paddock to paddock, property to property, and from district to district. This is especially so, perhaps, since the advent of bulk handling, where the farmer uses the same bags for collecting the harvest and for holding the next season's seed. Another avenue is where bagged wheat is bulked at the port and the bags are offered for resale.

Where a crop badly infested with wild turnip is harvested, the seeds of the weed are found to be thoroughly intermixed with the wheat grain in the bags. Owing to the small size of the wild turnip seeds, they are readily enmeshed and held between the wheat bag fibres; also the seed coat is of such a nature that it adheres readily to any loose fibres. The outer seed coat is mucilaginous, and when moistened the seeds become quite sticky and firmly glued to the fibres. If clean wheat grain is stored or placed in these bags before or during seeding operations, much of the mechanically held wild turnip seed is scrubbed out by the wheat grain, and, in this way, this serious weed pest may be spread to previously "clean" areas.

During this year the Department was approached by Mr. Rupert Orr, Newdegate, for a means of destroying the seeds enmeshed in the fibres of second-hand bags, so that the bags could be used with safety during seeding operations. It

was thought that the best means of eradication would be one in which the bags were soaked in chemical solutions, which would destroy the germinating power of the seeds. Experiments were initiated, using chemicals that were sufficiently cheap to justify the treatment and that were well known in other aspects of farming practice.

The first experiments were carried out with a parcel of rather old seeds which accounts for the low percentage germination; but the results indicated what treatments were likely to be effective. The second series of experiments was made with a parcel of seed received from Mr. Orr, of which the germination was not particularly high, but the response to chemical treatments was fairly conclusive.

In each section of the experiment about 200 seeds were used. The procedure was to tie them up in small butter muslin bags and immerse in the chemical solution of definite strength for the times as set out in the table below. The seeds were allowed to dry in the bags and then germinated on blotting paper.

RESULTS OF EXPERIMENTS.

1ST SERIES OF EXPERIMENTS—

Treatment.	Percentage Germination.
Untreated	7·3
Water—	
Soaked for 24 hours	13·5
Soaked for 1 week	7·0
Dipped in Boiling Water ...	0·
Superphosphate Solutions—	
1 lb. super. to 10 gals. water: Dipped for 1 hour and dipped in Limewater	22·0
1 lb. super. to 1 gal. water: Dipped for 1 hour and dipped in Limewater	28·6
Formalin—	
1 part of Formalin to 320 parts water:	
Soaked for 1 hour	0·
Soaked for 24 hours	0·
2 per cent. Solution:	
Soaked for 1 hour	0·
Soaked for 24 hours	0·
10 per cent. Solution:	
Soaked for 10 minutes ...	0·
Soaked for 1 hour	0·
Copper Sulphate (Bluestone)—	
1 per cent Solution:	
Soaked for 1 hour	0·
Soaked for 24 hours ...	0·
10 per cent. Solution:	
Soaked for 10 minutes ...	0·
Soaked for 1 hour	0·
Saturated Solution:	
Soaked for 5 minutes ...	0·
Soaked for 1 hour	0·
Common Salt—	
20 per cent. Solution:	
Soaked for 1 hour and washed in water 1 hour	0·

2ND SERIES OF EXPERIMENTS—

Treatment.	Percentage Germination.
Untreated	27·0
Water—	
Dipped in Boiling Water ...	0·
Formalin—	
1 part of Formalin to 320 parts water:	
Dipped until wet	9·5
Soaked for 5 minutes ...	8·5
Soaked for 20 minutes ...	2·5
2 per cent. Solutions:	
Dipped until wet	9·0
Soaked for 5 minutes ...	8·5
Soaked for 20 minutes ...	1·0
Copper Sulphate (Bluestone)—	
1 per cent. Solution:	
Dipped until wet	11·5
Soaked for 5 minutes ...	12·0
Soaked for 20 minutes ...	6·0
5 per cent. Solution:	
Soaked for 10 minutes ...	0·
Soaked for 20 minutes ...	0·
10 per cent. Solution:	
Soaked for 10 minutes ...	0·

In the boiling water treatment the muslin bag of seeds was dipped in until thoroughly wetted, then allowed to dry. After the superphosphate solutions it was necessary to dip the bags into lime water to neutralise the acidity of the superphosphate and prevent rotting of the bags. With the common salt treatment washing in pure water was necessary to remove a certain "stickiness" from the bags.

Treatments Recommended.

Although, as can be seen from the table above, most of the chemicals were effective in one strength or another in destroying the germinating power of the seeds, owing to practical difficulties of application some of the treatments have to be discarded.

Only the following are recommended:—

1. Dip the wheat bags, preferably turned inside-out, into vigorously boiling water until thoroughly wet; then spread out to dry; or

2. Immerse the bags, turned inside-out, in a 5 per cent. solution of copper sulphate or "bluestone" (5 lbs. bluestone dissolved in 10 gallons of water), for from 10 to 20 minutes and spread out to dry. More dilute solutions of bluestone eventually kill the seeds, but with the weaker strength germination commences and under "seed-bed" conditions in the soil some of these plants might survive. A 5 per cent. solution completely inhibits germination. Stronger solutions make the bags rather stiff and rather blue in colour. The bluestone solution should be used in a wooden barrel, washing copper, or some other container which will not be corroded by this chemical.

General Control Measures for Wild Turnip on the Farm.

Particulars of general field control of this bad weed will be found in previous articles in this Journal as follows:—

Journal of Agriculture of Western Australia, Vol. X., September, 1933, pages 409-419, The Wild Turnip (Brassica Tournefortii, Gouan), by C. A. Gardner, with notes on Cultural Methods of Control by G. L. Throssell, and

Journal of Agriculture of Western Australia, Vol. XI., June, 1934, pages 346-348, Wild Turnip (Brassica Tournefortii), Methods of Control by N. Davenport.

(It is realised that further experiments are necessary before the most satisfactory method can be discovered for the chemical destruction of *Brassica Tournefortii* seeds, but as the writer was until recently attached to the W.A. Dept. of Agriculture, and carried out the experiments recorded above while an officer of this Department, it is considered desirable that his pioneer work in this connection should be published at this stage. Further work can be continued from this point. —Editor.)

STRAIN CERTIFICATION OF AGRICULTURAL SEEDS.

Subterranean Clover (*Trifolium subterraneum*, Linn.).

G. R. W. Meadly, B.Sc., Agricultural Adviser.

Considerable advancements have been made during the last decade in various phases of agriculture, and not the least of these is due to the recognition of strains within the species of fodder plants. Variations in plants may occur naturally or be artificially induced, by cross pollination or inbreeding. These variations from the original type may be morphological such as change in leaf size and shape; or affect the growth periods of different sections of the plant.

The features of a plant which make it of value from a fodder view point include permanence, time of maturity, palatability, growth form, period of growth and seed production.

CERTIFIED SEEDS.

The aim of the plant breeder is to incorporate in one strain the most suitable factors for the conditions under which the plant is to be grown. Once this strain has been evolved either by the breeder or by natural selection, its perpetuation is an important item to be considered. A system which has been formulated to carry out this work is known as seed certification. New Zealand, which is one of the leading seed producing countries of the world, introduced seed certification in the 1929-30 season. One of the most variable species sold commercially is Perennial Rye grass, and the New Zealand Department of Agriculture commenced its activities in this direction by certifying true to type a permanent and leafy strain under the name of Hawke's Bay Perennial Rye grass. Since then New Zealand White Clover, New Zealand grown Montgomery Red Clover, and Akaroa Cocksfoot have been added to the list of certified strains. So successful has this system proved that it has been adopted in the main for Rye grasses and Toowoomba Canary grass in Australia.

In New Zealand any farmer desiring to produce certified seed makes application to the Department of Agriculture. He is allotted a register number and the paddocks, which are the working units, receive letters for identification. These figures and letters are noted on tags attached to all bags of seed produced, and hence it is possible to trace back to the paddock of origin any line of certified seed.

Field inspections are made during the growing period, and when the grower is prepared to thresh seed it is his responsibility to give notice of his intention to the Department. The inspecting officer endeavours to be present during or immediately after threshing to count, seal and brand the sacks. The grower or some responsible person must sign a declaration guaranteeing that the sacks the inspector has sealed and branded contain no seed other than the produce of the registered areas.

When a merchant desires to machine dress seed contained in bags sealed in the field, an officer—

1. Notes the number of sacks and their weight;
2. Removes the seals and allows machine dressing to proceed;
3. Supplies the number of tags required;
4. Inspects the dressing returns;

5. Notes the number of sacks and weight of dressed seed;

6. Seals up the sacks of machine dressed seed;

7. Draws samples which are forwarded direct to the Department's seed analyst for purity and germination tests.

The result of this test is forwarded direct to the grower or merchant owning the seed.

PEDIGREE SEED.

A further step in seed certification is the production of certified *pedigree* seed. After the isolation of the so-called ecotypes such as Akaroa Cocksfoot and Hawke's Bay Perennial Rye grass more intensive selection is carried on.

Studies of single plants are made and the types showing maximum desirable features are selected and studied for a number of years during which time selfing and parental crossing is carried out.

The initial production of pedigree seed is a very slow process. Small quantities are now being produced in New Zealand, and the Aberystwyth Plant Breeding Station in Wales, after about thirteen years of investigation work, is now commencing to place pedigree seed on the market on a commercial scale.

STRAINS OF SUBTERRANEAN CLOVER.

Recognising the value to both producer and purchaser of a strain certification system the Department of Agriculture is initiating this season a scheme to certify true to strain the very early (Dwalganup) strain of Subterranean Clover (*Trifolium subterraneum*), and certain areas of Dwalganup Subterranean Clover have been passed as suitable for certification for this season.

Subterranean Clover is of European or South Asiatic origin, and was evidently introduced to Victoria as an impurity in agricultural seeds during the latter part of the nineteenth century and apparently reached this State about the same time.

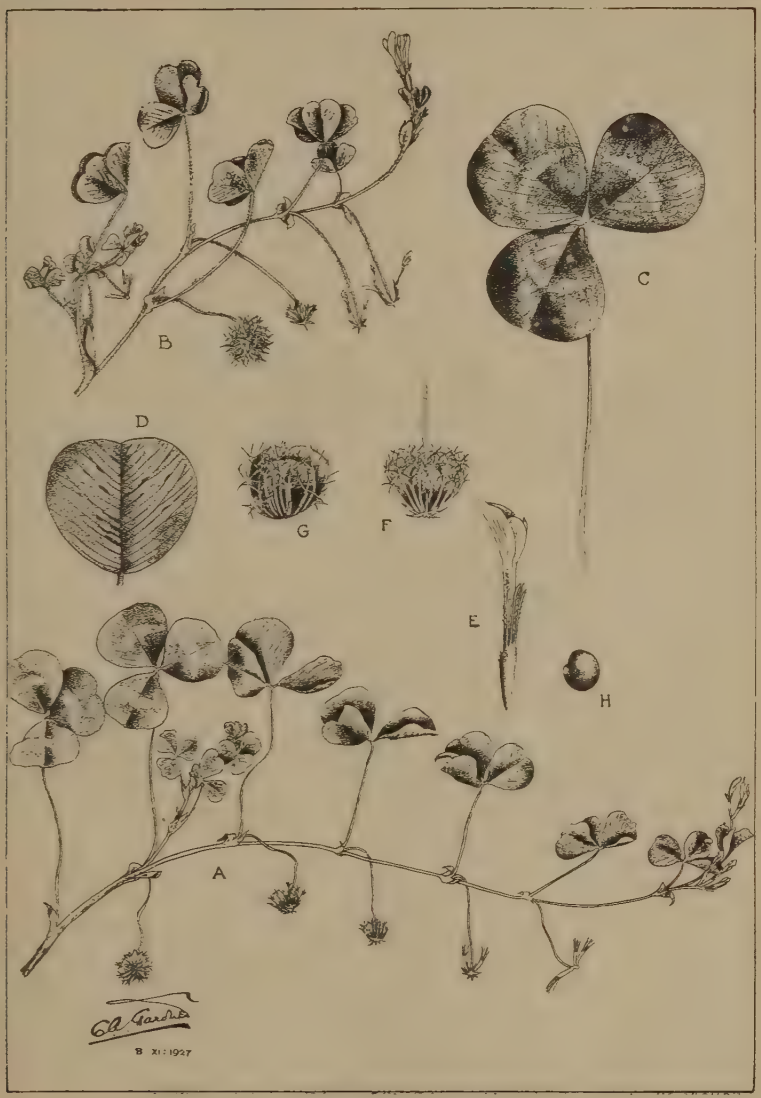
Various strains of this plant with different vegetative characters and growth periods have been noted from time to time until now in this State alone there are at least six recognised. Of these, Dwalganup (first early), Daliak (early), mid-season and Brunswick (late), are grown commercially for seed purposes. At present by far the two most important are mid-season and Dwalganup, and a few words concerning their characteristics will enable contrasts to be made.

The Dwalganup strain has fibrous trailing hairy stems with sparse leafage. White crescent-shaped markings and sometimes brown fleckings appear in the younger leaves, but these usually disappear later.

The calyx tube varies in colour from green to pink, the pink colouration being most pronounced (when present) at the apex of the tube. The plants normally commence to flower early in August, and by the end of September seed formation is well under way in the buried burrs.

Seed formation is heavier than in the case of mid-season, but apparently very few, if any, seeds will set in the burrs of the Dwalganup strain unless they are buried in the soil. This does not apply in the case of mid-season.

Dwalganup is a very hardly strain and the one most suitable for the areas of lighter rainfall, the limiting rainfall being in the vicinity of 17 inches.



SUBTERRANEAN CLOVER.
(*Trifolium subterraneum, L.*).

PLATE I.

Explanation of Plate.

A. and B.—Portion of plant showing habit and development.
C.—Leaf showing whitish crescent-shaped markings.
D.—Leaflet with brown flecking (on veins near midrib).
E.—Flower.
F.—Maturing seed head.
G.—Ripe burr with three pods.
H.—Seed.

[After C. A. Gardner, Journal of Agriculture, Vol. X., March, 1933.]

The mid-season strain has shorter hairy stems and flower stalks and more abundant foliage. There is a decided, persistent, white crescent on the leaves, and brown markings may also be present. The calyx is bright red in the upper two-thirds, the remainder along with the teeth being green. Flowering usually commences in the latter part of September, with a correspondingly later seed setting. This strain is the one most commonly cultivated in the lower South-West and is suitable as far East as the 25-inch isohyet.

In the past some purchasers of so-called Dwalganup seed have found that the crop produced has consisted in part, or entirely of the mid-season strain. Although the former is not so leafy, it will grow and produce seed under considerably drier conditions, mainly owing to its earlier maturing habit. Besides often entailing the loss of a suitable crop, supplying seed of incorrect strain tends to convince a farmer that no strain of that particular plant will grow under his conditions.

CERTIFICATION OF SUBTERRANEAN CLOVER.

With the idea of protecting the farmer and at the same time assisting the grower and seed merchant, this certification scheme for Dwalganup Subterranean Clover has been evolved.

During October, at the request of various growers, areas of Subterranean Clover were inspected and those considered to contain a sufficiently high percentage of Dwalganup strain were passed for certification if so desired. Each producer was allotted a number and each paddock mapped was distinguished by a letter. It is intended to include the number and letter on the tag attached to each bag of certified seed. This tag will also bear the number of the test conducted on the seed for purity and germination. The results of this test may be secured by forwarding the reference number to the merchant from whom the seed was purchased.

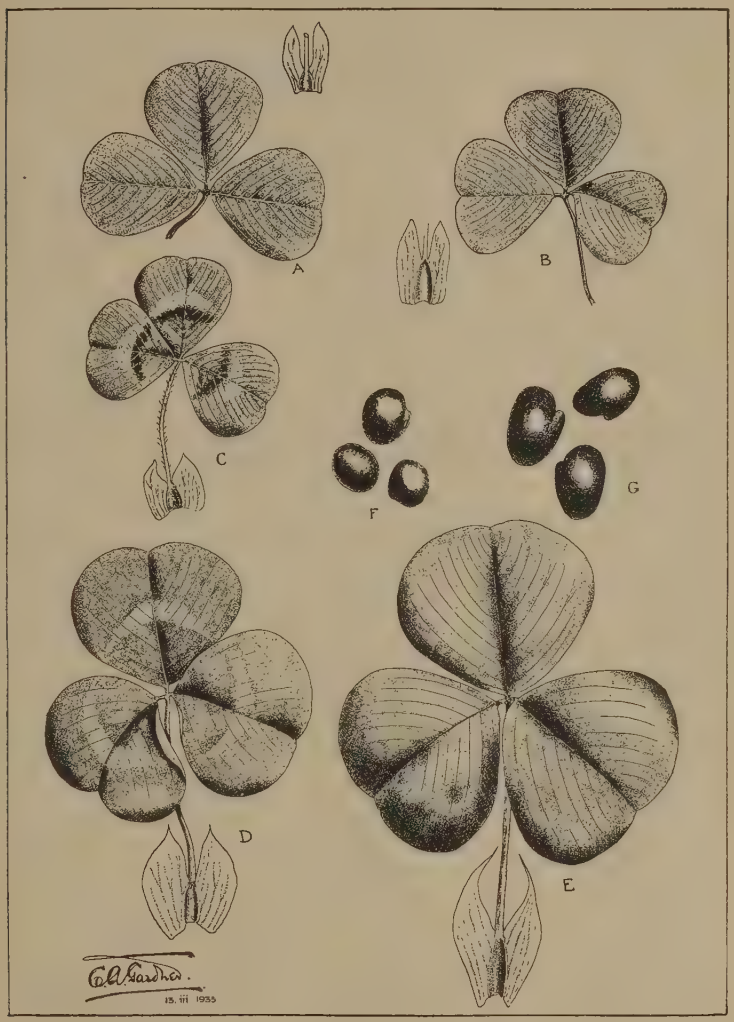
An officer of the Department will be present to note the areas from which the seed is gathered, seal the bags of certified seed, and attach the tag giving information concerning the seed. This seal remains intact until broken by the purchaser, thus ensuring the delivery of a reliable strain of seed.

FLUORESCENCE IN SUBTERRANEAN CLOVER SEEDLINGS.

H. C. Trumble, in the Journal for Scientific and Industrial Research, August, 1933, makes the following statement: "During the course of the work various pasture species have been subjected, whilst germinating on filter paper, to the ultra-violet light test. It has been found that whereas South Australian Commercial Subterranean Clover seed is non-fluorescent, an early flowering type from Dwalganup (W.A.) which is becoming increasingly important in the lower rainfall areas, is fluorescent. The fluorescence is, however, faint and unlike Rye Grass, the causal substance is confined to the root tissue and not exuded."

Because of the extreme importance locally of being able to distinguish between Dwalganup (extra early) and mid-season Subterranean Clover seed, especially in view of the certification scheme, a number of tests were conducted.

Several different lines of Dwalganup, mid-season and Wenigup strains of Subterranean Clover seed were germinated on moist white Whatman filter paper, and each allowed to continue growth for the same length of time (4 days and 6 days in the two series conducted). When these seedlings were viewed under screened ultra-violet light (4,000-5,000 augstrom units) from a mercury vapour



SUBTERRANEAN CLOVER.

PLATE II.

Leaves.

A.—First Early Strain.
B.—Daliak Strian.
C.—Northam Early Strain.
D.—Midseason Strain.
E.—Brunswick Late Variety.

Seed.

F.—Midseason Strain.
G.—Brunswick Late Variety.

[After C. A. Gardner, Journal of Agriculture, Vol. X., March, 1933.]

lamp, a marked difference in the fluorescence of the three strains tested was noted. The fluorescing substance was apparently retained within the root except for small amounts at the junction of the filter paper and the root apices.

Maximum fluorescence was obtained with the Dwalganup strain which produced a bright blue root colouration. The Wenigup gave a pale greenish-blue, and the mid-season was intermediate between the two.

By using controls of Dwalganup and mid-season, ultra-violet light will probably be of extreme importance in detecting the presence of mid-season strain contamination in Dwalganup seed. Further investigational work along these lines should prove of value.

The apparatus used in these tests was kindly loaned by Mr. J. E. Blewett, local manager of H. Watson and Sons, Limited.

A NEW METHOD FOR THE PROPAGATION AND DISTRIBUTION, ON A SOLID MEDIUM, OF THE CHEESE STARTER ORGANISM, STREPTOCOCCUS CREMORIS.

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INTRODUCTORY.

A study of the "Statistical Register" of Western Australia for 1932-33 and previous years, which is compiled from official returns by the Government Statistician, Mr. S. Bennett, F.I.A., shows that there is an enormous scope for expansion of the local Cheddar cheese-making industry.

Thus the annual production of cheese for the whole of Western Australia, as therein set forth, for the years 1923-32, both inclusive, was as follows:—

Year.	Cheese made (lbs.).
1923	4,365
1924	4,055
1925	3,818
1926	164,472
1927	149,269
1928	11,847
1929	998
1930	623
1931	909
1932	138,051

By contrast with this lilliputian production, the figures for the value of cheese *imported* into Western Australia during the same period are comparatively enormous. These are as follows:—

Year.	Value of Cheese Imported in £'s.
1923-24	87,191
1924-25	70,533
1925-26	86,144
1926-27	87,602
1927-28	87,268
1928-29	106,626
1929-30	114,245
1930-31	87,739
1931-32	90,859
1932-33	88,364

The total amount of cheese produced locally in the last statistical period (1933-34) was 285,461 lbs. and the value of cheese *imported* into the State in the same period was £83,601, representing a value of £83,361 for imports from the Eastern Australian States, and £240 for imports from overseas (the respective *weights* of imports being 1,982,451 and 4,082 lbs.).

USE OF CHEESE STARTERS IN W.A.

Following on the establishment of the Serpentine Falls Cheese Factory at Serpentine, Western Australia, in August 1932, this Department was asked to undertake the work of propagating and distributing pure cultures of the lactic acid organism, *Streptococcus cremoris*, to the factory at frequent intervals, for use as cheese starters.

For several months the factory had been using cultures of this organism which were obtained, as required, from the Department of Agriculture, New South Wales; but it had been found that owing to the length of time taken for the cultures to arrive from Sydney, on the other side of the continent two thousand miles away, they were frequently rather reduced in vitality on arrival, and moreover, a very awkward and perturbing period of a week or so frequently elapsed between the time of contamination of the factory starter and the arrival of a new, uncontaminated one from the East.

The Superintendent of Dairying, Mr. G. K. Baron-Hay, therefore inquired of the writer whether it would be possible for the latter to prepare and distribute such cultures to the factory at regular intervals, as the Plant Pathology Branch had for many years been preparing and distributing to farmers pure cultures of the nitrogen-fixing organism *Rhizobium radicicola*, for the inoculation of leguminous seeds before planting. He was informed that if a pure culture were obtained as a starting point, and the formula for preparing the most suitable artificial media indicated, every assistance would be given. For a number of years the writer had been out of touch with developments in the dairy starter line, and assumed that during that time scientific knowledge on the subject would probably have increased to include a method whereby the organism would be culturable on solid media and would require only infrequent transfers from the old to new media to retain its vitality.

On the arrival of the first pure culture from Dr. R. J. Noble, Biologist, New South Wales Department of Agriculture, it was found that the task so lightly undertaken was to prove much more troublesome and time-consuming than had been anticipated, as the instructions received with the culture were to the effect that the organism had to be subcultured into a new lot of sterile milk every day, but, fortunately, could be kept alive over public holidays of a day or so, or over week-ends, in sterile milk to which a considerable amount of calcium carbonate (chalk) had been added before sterilising.

THE SEARCH FOR A SIMPLIFIED TECHNIQUE.

As the miscellaneous routine and research activities of the Plant Pathology Branch already consumed all the available time each day, without extra activities being undertaken, the writer immediately set about to try and invent some artificial medium of a solid kind on which the organism could be propagated and on which it would retain its vitality unimpaired for several weeks at least. The agar used for distributing the organism from the New South Wales Department of Agriculture is standard nutrient agar, on which the growth of the organism is so meagre that it is only with difficulty that it can be distinguished. A type of colony growth which would be more readily discernible to the naked eye was therefore desired.

With these varied ends in view, then, a considerable number of different types of solid media were made up, as, for example, "meat lactose agar," "meat lactose agar plus calcium carbonate," "milk agar," "milk agar plus calcium carbonate," "powdered skim milk agar," "powdered skim milk agar plus calcium carbonate," "powdered skim milk peptone agar" and "powdered skim milk peptone agar plus calcium carbonate." The *modus operandi* was to inoculate the various kinds of agar slopes with a nicrome wire loopful of organisms from sterilised milk which had itself been inoculated with the pure culture, and which was on the point of turning, or had just turned, thick. The growth, if any, was then observed for some days, and at the end of varying periods of time, the organism was subcultured from the solid medium into sterilised milk, and its vitality (if any) observed by the speed with which curdling took place.

THE NEW TECHNIQUE DESCRIBED.

For one reason or another all the above types of media were ultimately abandoned as unsatisfactory, and all subsequent work has been carried out on an agar medium which has proved very satisfactory for propagating the organism, and for retaining its vitality unimpaired for approximately thirty days.

After this period the vitality falls off fairly rapidly, but the organism has frequently been obtained in perfectly vigorous condition from an agar slope at the end of thirty-one or thirty-two days. Such a procedure is not recommended, however, as it has been found better and safer, in routine work, to subculture from the solid medium into sterilised milk or "milk carbonate" (*i.e.*, milk containing calcium carbonate) when the culture is not more than ten days or a fortnight old, although if absolutely necessary, the organism may frequently be obtained in viable but not very vigorous condition from agar cultures forty days old. After subculturing from the solid medium to sterilised milk, the organism is resubcultured into two further changes of sterilised milk at daily intervals, before being transferred onto a new agar slope from the third batch of sterilised milk. Here again the organism can be left for ten days or a fortnight without any fear of its vitality diminishing, at the end of which period the subculturing into sterile milk for three repetitions, or into sterilised milk carbonate takes place. If subcultured into sterilised milk carbonate, experience indicates that resubculturings into sterilised milk carbonate are unnecessary except at weekly intervals. It appears that by weekly subculturings into milk carbonate the vitality of *Streptococcus cremoris* may be retained unimpaired indefinitely.

VALUE OF THE NEW AGAR MEDIUM.

This being so, the great value of the new agar medium is that the freedom of the culture from contamination can be determined by eye, from time to time, by subculturing from milk or milk carbonate to the solid agar medium; and the cultures which are to be distributed to cheese factories can be grown for a week, two weeks, three weeks, or longer, if necessary, on the artificial solid medium before being sent out from the laboratory. This allows of contamination with spore-forming organisms or other harmful types (if any) showing up before the cultures are forwarded, and the absence of a liquid medium obviates the possibility of leakages from the starter bottle, and subsequent possibility of contamination, before the culture arrives at its destination.

Several cheese starters recently arrived from the U.S.A. in the traditional milk plus calcium carbonate medium. The gas pressure which had developed during the voyage resulted in leakage past the "screw-on" stoppers into the surrounding sawdust packing. The result was a very copious growth of miscellaneous moulds on the stoppers and necks of the bottles, which was not conducive to pleasant work, or work free from the likelihood of contamination during subculturing

in the laboratory at the receiving end. Such a state of affairs would be obviated with a satisfactory solid medium for propagation and distribution of the cultures.

PREPARATION OF THE NEW AGAR MEDIUM.

The solid medium which was worked out by the writer in this laboratory, and which has been in use for the past two years, is known as "Peptone-lactose-phosphate-carbonate agar, usually designated "Peptone carbonate agar," or "P" agar for sake of brevity.

The formula for its preparation is as follows:—

1.	Peptone	10.0 gms.
2.	Lactose	50.0 gms.
3.	Calcium carbonate (precipitated)	100.0 gms.
4.	Tricalcium phosphate (P.B.)	12.5 gms.
5.	Water (tap)	1000.0 ccs.
6.	Powdered agar agar	25.0 gms.

(Peptone ten gms., lactose fifty gms., calcium carbonate one hundred gms., tricalcium phosphate twelve decimal five gms., water one thousand ccs., agar twenty-five gms.)

Autoclave the agar in the water till dissolved (say 30 minutes). Filter through cotton wool; squeeze out cotton wool by hand so as to obtain as much of the agar as possible. Add chemicals No. 1 to 4, both inclusive. Keeping the agar well rotated in the flask while pouring, to thoroughly incorporate the insoluble chemicals, pour into 2 oz. medicine flats or other suitable containers, insert the cotton wool plugs, sterilise in autoclave for 15-20 minutes at 15 lbs. pressure and slope. Just before sloping each bottle it should be well rotated in the hands so as to ensure good distribution of the insoluble materials, and should then be placed in a sloping position, without delay, for the agar to set. Frequently a little of the insoluble matter will become attached to the sides of the bottle, so that the clarity of the view through the glass may be somewhat impaired in spots. With care in the preparation of the medium, and the use of well-cleaned bottles, there should be very little adherence of calcium salts to the sides of the bottle.

Sometimes, for reasons not known, the bottles will be found, after the agar has solidified, to have a little free water at the bottom of each slope. As our invariable practice is to make up the slopes some weeks in advance of the time when they will be required for subculturing purposes (so as to avoid the possibility of using imperfectly sterilised slopes, etc.), this is not a disadvantage, as the excess water becomes absorbed before they are used.

DEVELOPMENT OF THE COLONIES.

On this medium, after inoculation with a nichrome wire loop of approximately 2.5 mms. diameter from the sterile "milk carbonate," or sterile milk, the organism becomes obvious to the naked eye as tiny, raised, colourless, glistening, pin-point colonies along the track traced out by the wire during the smearing of the loopful of liquid medium over the surface of the agar. At a room temperature of about 70 deg. F. the organisms first become obvious as individual colonies on about the third day after subculturing. Thereafter the individual colonies grow rather rapidly, rarely however exceeding about 0.5 mm. in diameter, even in very old cultures. In spite of the colourless, or almost colourless, nature of the colonies, they are very readily distinguishable by the naked eye, especially if the bottle is rocked slightly in the hand with a strong light shining on to the surface of the culture from one side. Where a number of colonies are growing in close proximity they may fuse to form a rather slimy continuous mass, but there is never sufficient

growth formed to "flow" down over the slope as occurs in the case of many bacterial cultures. As the colonies develop, the lactic acid formed passes down into the substratum and dissolves away the calcium carbonate, forming large clear pockets in the carbonate layer. Subculturing *from* a solid medium *to* a solid medium does not seem to be very satisfactory.

Fig. 1.—Five 2-oz. medicine "flats" containing "Peptone-lactose-phosphate-carbonate agar" slopes, made up as indicated in the text, and photographed from the side to show the heavy (white) layer of calcium carbonate below the surface of the agar. Some of the carbonate has adhered to the sides of the bottles during preparation of the slopes; but the amount and opacity of this has been exaggerated in the photographic process.

[*Photo. by Govt. Printer.*]

PREPARATION AND USE OF "MILK CARBONATE."

In preparing "milk carbonate," approximately ten grammes of precipitated calcium carbonate is placed into a 2-oz. medicine "flat" and approximately 25ccs. of whole milk is then run into the bottle. The carbonate need not be weighed out but may be estimated by eye. Ten grammes represent a height of about one inch in a two ounce medicine "flat." The milk similarly need not be measured out, but may be run into the bottles until the carbonate is quite wet and about five-eighths of an inch of milk, or slightly more, extends above the surface of the carbonate.

To ensure a considerable amount of mixing of the milk and carbonate, a day or so after subculturing has occurred, and when the milk has become more or less thick, the bottles are repeatedly lightly tapped on a wooden bench, while being held tilted at an angle of about 45 degrees, so that one corner of the bottle only

strikes the bench. This disturbs some of the carbonate and subsequent twisting of the bottles back and forth about their vertical axis ensures neutralisation of the lactic acid and the evolution of considerable gas. The curd also becomes more or less emulsified again as a result of this agitation.

With care, the splashing of milk on to the plug of the bottle can be avoided. When subculturing into or from "milk carbonate," the opportunity is taken to stir up the carbonate with the nicrome wire as much as possible. Some experiments are now being carried out to see if the addition of short lengths of glass rod to the bottles, before they are sterilised, will facilitate the mixing of the carbonate with the milk, without opening the bottles. Results to date indicate that the addition to each bottle of several pieces of glass rod, approximately three-eighths of an inch long and one-quarter inch diameter, greatly assists the disturbance of the carbonate, which otherwise tends to form a hard compact mass in the bottom of the bottle.

STERILISING OF MILK AND "MILK CARBONATE."

In connection with the sterilising of the milk, with or without carbonate, experience indicates that it may be necessary to use the discontinuous process in the steam steriliser for half an hour on each of six successive days, with a further sterilising on one or more days in the following week, before sterility can be safely assumed. The safest way is to give six to nine such sterilisings and then leave the bottles standing on shelves in a cupboard for a fortnight or more before being used. In the event of living spore-formers still being present after apparent sterilisation, it may be ten days or so before clearing of the curd or other changes in the milk develops to indicate non-sterility. During the protracted sterilising indicated above, it often happens that the milk becomes slightly brownish in appearance. So long as this is not very marked the vitality of the *Streptococcus cremoris* does not appear to be affected. In most of the work carried out in the writer's laboratory whole milk has been used, as it is difficult to obtain fresh skimmed milk locally. Until the necessity for great caution in presuming sterility had been learned, by bitter experience, a great deal of trouble with cultures becoming contaminated with spore-formers originally present in the milk was experienced.

SUMMARY OF SALIENT POINTS CONCERNING ROUTINE PREPARATION OF STARTERS.

During the two years that the writer has been distributing cheese starters to local factories (there are now three of them in operation) a total of approximately 1,200 subcultures have been made for various purposes, most of them being made by the writer. One culture is forwarded to each of the three factories each week, the cultures being usually about ten days or a fortnight old when sent out. It is considered that by weekly subculturing into sterilised milk carbonate to keep the line of "mother" starters going, by subculturing from milk carbonate to peptone-lactose-phosphate-carbonate agar for distribution (and "inspection") purposes, and by subculturing from cultures on this agar which are not more than two weeks old back into milk (three transfers), or into milk carbonate, the vitality of *Streptococcus cremoris* as a very vigorous cheese starter can be maintained for very long periods. My experiments show that the organism readily dies out in milk after the second day at a room temperature of about 75 degrees F. (although it may occasionally be recovered in a weakened condition from milk after four days); that it will live in milk carbonate for approximately a month at this temperature, without loss of vitality, if the precaution is taken in some way to keep the carbonate and milk intimately mixed every few days, especially at the beginning of the period; that it will live for approximately a month on the special agar already de-

scribed without loss of vitality: but that *it is the best and safest practice to subculture it from milk at the end of twenty-four hours, from milk carbonate at the end of a week (as a maximum period), and from the special new agar at the end of a fortnight (again as a maximum).*

When subculturing into, or from, the medicine "flats," the necks of the bottles must always be very well flamed (while the bottles are being twisted in the hands to prevent cracking of the glass), as there is frequently a bevelled inner edge to the neck of these bottles in which dust particles may settle from the air, after the medium has been prepared, and while it is being stored on a shelf before use.

Fig. 2.—From left to right—(a), "Leatherboard" box for distributing cheese starters and other bacterial cultures viewed from the side. (b) Same as (a), but viewed from above [illegible] box; (c), Bottom of box with shaped piece of corrugated cardboard below bottle, and [illegible] medicine "flat" containing "Peptone-lactose-phosphate-carbonate" agar and cultures of [illegible] cremoris. The cotton wool plug has been blackened by flaming during the subculturing process and does not show very clearly in the photograph. Before despatch, the necks of the bottles and plugs are very well flamed by rotating in the flame of a Bunsen burner, the latter then being pushed well down into the bottle until the heavy cotton wool plug from a right angle [illegible] (d), Lid of box with shaped piece of corrugated cardboard inside to take up the space and offer protection to the top of the bottle.

[*Photo. by Govt. Printer.*]

Owing to the absence of a low temperature incubator, all the work which has been done with this organism locally has perforce been carried out at room temperature. This varies in mid-summer from approximately 34 degrees C. (93.2 degrees F.) to approximately 12 degrees C. (53.6 degrees F.) in mid-winter. The cultures are kept in complete darkness, except when being actually worked with in the laboratory.

A NEW METHOD OF DISTRIBUTING BACTERIAL CULTURES BY POST.

The cultures on the new agar are distributed to the cheese factories in small, good quality "leatherboard" boxes, which are fastened with a gummed wrapper rolled round the box as indicated in Fig. 3. The wrapper is 2 feet 3 inches long and 4 31 32nd inches wide, and is *completely* covered with best quality adhesive gum on the back. It is long enough to completely wrap around the box four times plus an overlap of about 1§ inches. The wrapper is placed gum side uppermost on the laboratory table, with the "top" end caught in a wide-mouthed spring paper clip, temporarily fastened to the table. A little water is wiped over the gummed surface and the box is then rolled up in the wrapper, starting from the "bottom"

or free end of the wrapper (which is devoid of printing). The spring clip keeps sufficient tension on the wrapper to prevent buckling of the paper as the box is being rolled up in it. This method is also used for distributing nitrogen-fixing bacterial cultures to farmers, for the inoculation of leguminous seeds before planting. It is very quick, and has resulted in a great saving of time over the old method of wrapping in corrugated cardboard, brown paper and string. To take up the slack inside the box an oblong piece of corrugated cardboard is placed above and another below the bottle, in the case of cheese starters, but not in the case of cultures of nitrogen-fixing bacteria, as in this latter case the slack is taken up by a small packet of tricalcium phosphate and the printed directions sent out with each culture.

DETAILED DESCRIPTION OF PRINTING ON GUMMED WRAPPER.

On one end (the "top" end) of the non-gummed side of the wrapper is printed: "O.H.M.S., Bacterial culture for ..... Only, from Department of Agriculture, Perth, W.A.," and the words "GLASS WITH CARE" are printed in red printer's ink four times down the left hand side of the wrapper and the same number of times down the right hand side. The repetitions are so spaced that no matter how the wrapper is applied, each side of the box will show this warning caption at least once. Only five of these eight "Glass with Care" signs are required on boxes containing 2-oz. "flats," but as the same wrapper is also used for 8-oz. bottles (of nitrogen-fixing bacteria) the three extra repetitions are then revealed, owing to the larger periphery of the bigger box. On the left hand side of the wrapper

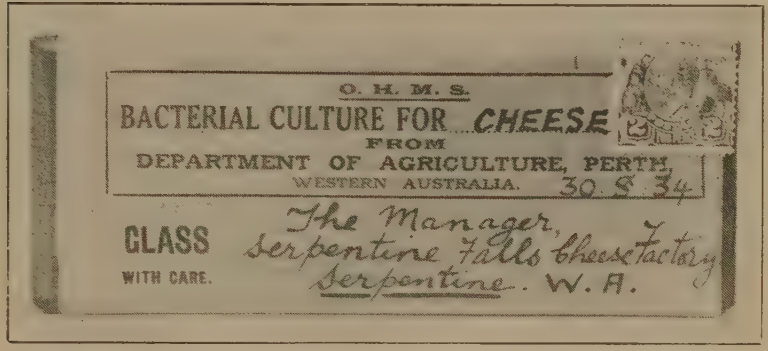

Fig. 3.—"Leatherboard" box, as pictured in Fig. 2, containing culture of *Streptococcus cremoris* in 2-oz. medicine "flat" on "Peptone-lactose-phosphate-carbonate agar," wrapped in special gummed wrapper described in text and ready for despatch through the post. From the point of view of complying with the postal regulations it is advisable to add the word "ONLY" after or below the word denoting the type of culture being forwarded, and this should not be obscured or obliterated by the postage stamp, etc.

[*Photo. by Govt. Printer.*]

the warning caption commences 7 32nds of an inch from the black border line below "Western Australia," but on the right it starts 1 11 32nd inches below this line. (See Fig. 3.) This gives a "staggered" effect to the warning words, and ensures that on each of the two narrow sides of the box the red ink notice appears once, but on the bottom of the box it appears twice (*i.e.*, on one pair of left and right diagonally-opposite corners). The vertical distance between the bottom of one "Glass with care" notice and the top of the one beneath it is 1 21 32nd inches. The area within the black border to the printing at the top of the wrapper is 15 16th of an inch wide, and the border is placed 3 16th of an inch below the top edge of the paper. The 2-oz. boxes, with the lids on, and empty, measure 5¼ inches long, 2¼ inches wide, and 1⅛ inches high.

SAFETY OF THE CULTURES IN THE POST.

Although many hundreds of cultures of various sorts have been sent out in this way through the post, no breakages of 2-oz. bottles have been reported, and since a piece of corrugated cardboard has been used above and below each 8-oz. bottle as a routine procedure and "Glass with Care" notices have been printed on the wrappers in the manner indicated above, no breakages of 8-oz. bottles have occurred. When the gummed wrappers were first introduced they were devoid of such notices and several breakages of the large-sized bottles occurred, possibly owing to the too zealous cancellation of the postage stamps by the post office officials.

KEEPING OF RECORDS.

In propagating the cheese starters it is of great assistance if a record of the various subculturings is kept by the use of foolscap sized paper forms, on which rows of empty oblongs, each about one and three-quarter (1¾) inches long and three-quarters (¾) of an inch wide, are printed. Each of these oblongs represents one (2-oz.) bottle. There is a space of about one-half inch between each diagrammatic representation of a bottle and its neighbour, and about one and a half inches clear space between each horizontal row of bottles.

The type of medium being used, and the number of the culture being worked with, is entered in one of these spaces for each separate bottle. When various subcultures are made from the same bottle thus represented on the chart, lines are drawn to the various bottles in the row(s) below which represent the individual subcultures. These are each numbered and the type of medium written into the appropriate oblong. The date can also be written into the space representing the bottle, or, if a number of subcultures are made on the same day, the whole group of bottles used can be ruled off and the date put in the margin.

By some such scheme as this it is easy to see at a glance what cultures are on hand, their varying ages, and the necessity for further subculturings being carried out by a certain date. The history of each culture is also able to be traced out without any trouble.

As the various cultures are forwarded to the cheese factories, they are crossed off the record sheets, and a further separate record of the number and "date of birth" of each culture which has been forwarded, with date of its despatch, is kept on a card index.

FURTHER WORK REQUIRED.

As indicated above, the work outlined in this article was undertaken under the spur of necessity, as the miscellaneous daily activities of the Plant Pathology Branch were already so heavy that the additional daily subculturing of cheese starters, which is required by the conventional method of propagating them, could not be contemplated with anything like equanimity. Lacking a special officer to attend to this work, it appeared that the propagation of these cultures would become a burdensome tie to Head Office and would prevent any lengthy visits to the country. The invention of the new agar has very much lightened the work and allowed of fairly long absences from Head Office, as cultures can be prepared, before departure, with instructions that they be despatched on a certain date in the absence of the officer responsible for their propagation.

No systematic research work on the problem has been possible owing to pressure of other matters, and it is possible that great improvements and labour-saving devices can still be introduced into this field. The results given above are now published in the hope that they may stimulate other workers with more time at their disposal, and more extensive equipment than that available to the author, to investigate what appears to be a much neglected aspect of the propagation of cheese and butter starters.

METEOROLOGICAL INFORMATION.

Stations.	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	SEPTEMBER, 1934.						OCTOBER, 1934.						NOVEMBER, 1934.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	70·1	79·8	46·1	39·6	1·64	1·61	77·5	92·4	48·7	41·9	0·24	1·00	84·0	98·0	55·3	48·0	0·34	0·31
Geraldton	70·0	76·0	52·5	43·0	0·50	1·36	72·0	88·5	51·6	42·8	0·25	0·74	78·8	95·0	58·3	47·0	0·23	0·25
Walebing	64·1	78·2	44·1	35·1	1·46	2·15	75·2	96·0	45·2	35·6	0·31	1·38	79·5	96·1	50·1	42·2	0·75	0·52
Perth	66·4	77·8	51·4	43·3	3·32	3·44	69·1	83·0	50·6	45·0	0·98	2·24	74·1	89·6	55·1	48·0	0·72	0·77
Kalamunda	63·6	74·0	49·0	41·2	4·60	4·67	68·2	81·0	48·5	41·2	1·41	3·20	74·1	90·0	51·5	44·2	1·07	0·96
Bunbury	65·1	78·4	49·3	38·8	3·53	3·64	66·2	72·2	48·1	37·8	0·88	2·43	71·0	77·0	51·1	42·2	0·60	0·98
Bridgetown	61·9	79·0	43·1	33·0	4·53	3·97	68·6	82·0	44·0	33·2	2·01	3·00	75·3	97·0	43·1	32·0	1·46	1·11
Albany	64·4	76·0	48·8	42·3	5·57	4·17	65·2	75·0	48·8	43·0	3·44	3·25	66·5	74·8	51·9	43·8	2·01	1·43
Merredin State Farm	69·4	84·0	42·8	32·5	0·61	0·88	77·4	96·6	44·8	34·1	0·32	0·85	79·4	97·1	50·8	41·0	0·54	0·41
Northam	68·5	80·0	46·0	36·6	1·00	1·61	74·1	91·0	45·9	38·0	0·21	1·05	78·0	92·4	51·5	41·4	0·52	0·37
York	67·7	79·0	44·2	36·0	1·30	1·60	73·2	91·8	43·7	30·5	0·31	1·10	77·3	94·5	49·9	42·6	1·13	0·11
Narrogin State Farm	64·1	75·4	43·5	34·2	1·58	2·30	60·4	86·5	41·0	31·0	0·73	1·47	75·2	89·6	45·6	37·0	0·75	0·54
Katanning	63·1	75·0	44·5	33·7	1·86	1·96	67·8	85·0	43·2	35·0	0·77	1·57	73·5	89·1	45·9	37·1	0·58	0·66
Cape Leeuwin ...	63·2	68·0	53·0	48·0	4·00	3·48	63·1	68·8	53·8	48·0	2·00	2·91	67·2	71·2	55·1	49·0	1·13	1·21

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